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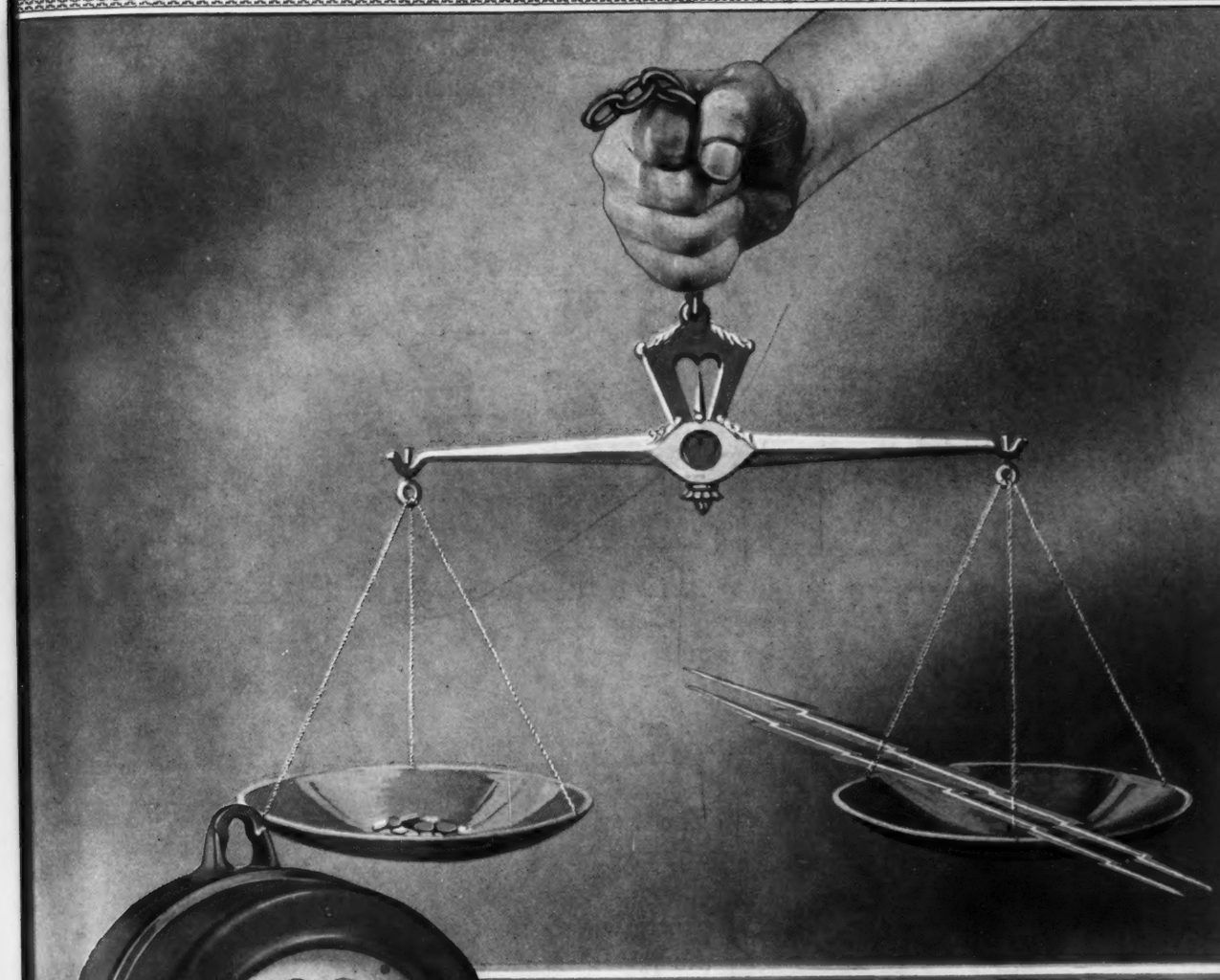

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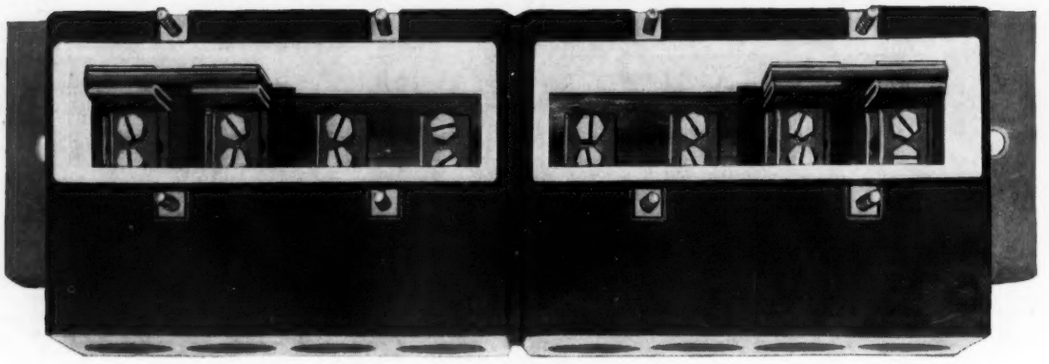

Covers removed from a group of two units showing secondary connections and six taps.

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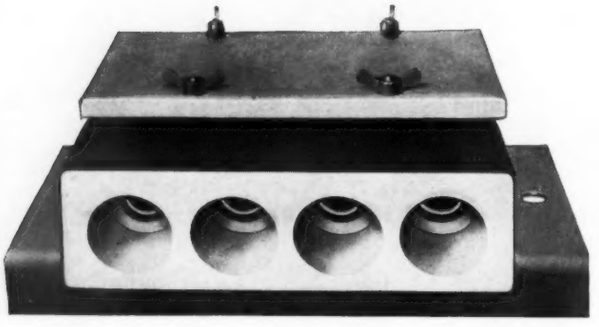

View of single sectionalizing unit from the bottom showing removable lugs into which cables are sweated.

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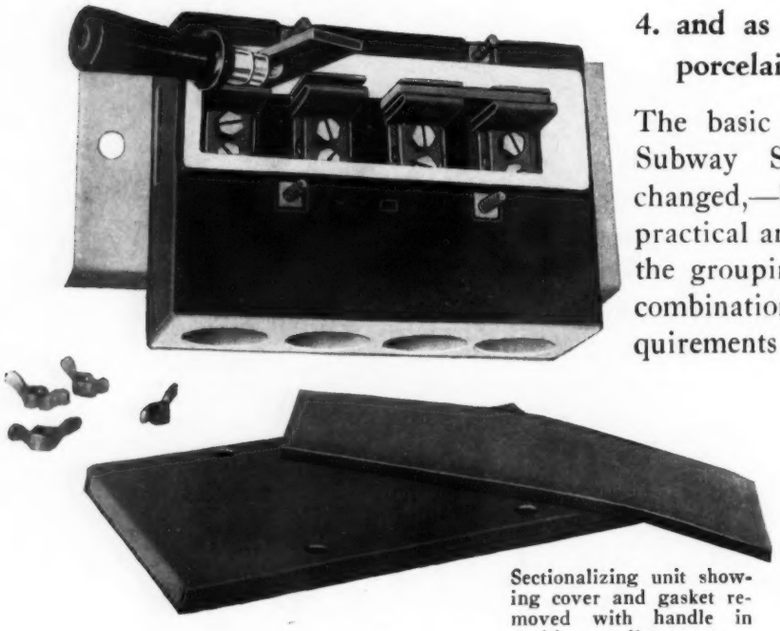

Sectionalizing unit showing cover and gasket removed with handle in position to disconnect.

Metropolitan Device Corporation

1250 Atlantic Avenue BROOKLYN, NEW YORK

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News Across the Sea

BEGINNING with this issue, the ELECTRICAL WORLD expects to print once in each month, in "News of the Industry," a letter from the editor of *The Electrician*, its able and well-known London contemporary. In return *The Electrician* will print each month a letter from a staff editor of the ELECTRICAL WORLD. It is thought that this regular interchange of news and comment, credit for suggesting which belongs to *The Electrician*, will prove of interest to the subscribers of both papers, affording them respectively a periodic and coherent check on leading electrical events in the other English-speaking nation, instead of haphazard and unconnected items at irregular intervals.

Great Britain is on the threshold of a new electrical era with co-ordinated development and scientifically planned generation, transmission and distribution. America is in the full swing of movements begun years or decades ago, but requiring constant revision and extension to keep them abreast of the nation's needs. Differences in territorial size, in political methods and in national temperament provide contrasts in electrical doings between the old land and the new. To bring these contrasts into relief, and perhaps to show—indirectly, not by preaching—what each nation may learn electrically from the other, should make worth-while and profitable reading. The ELECTRICAL WORLD feels certain its own readers will welcome the arrangement, and it hopes that the subscribers of *The Electrician* will not think it a fruitless one.

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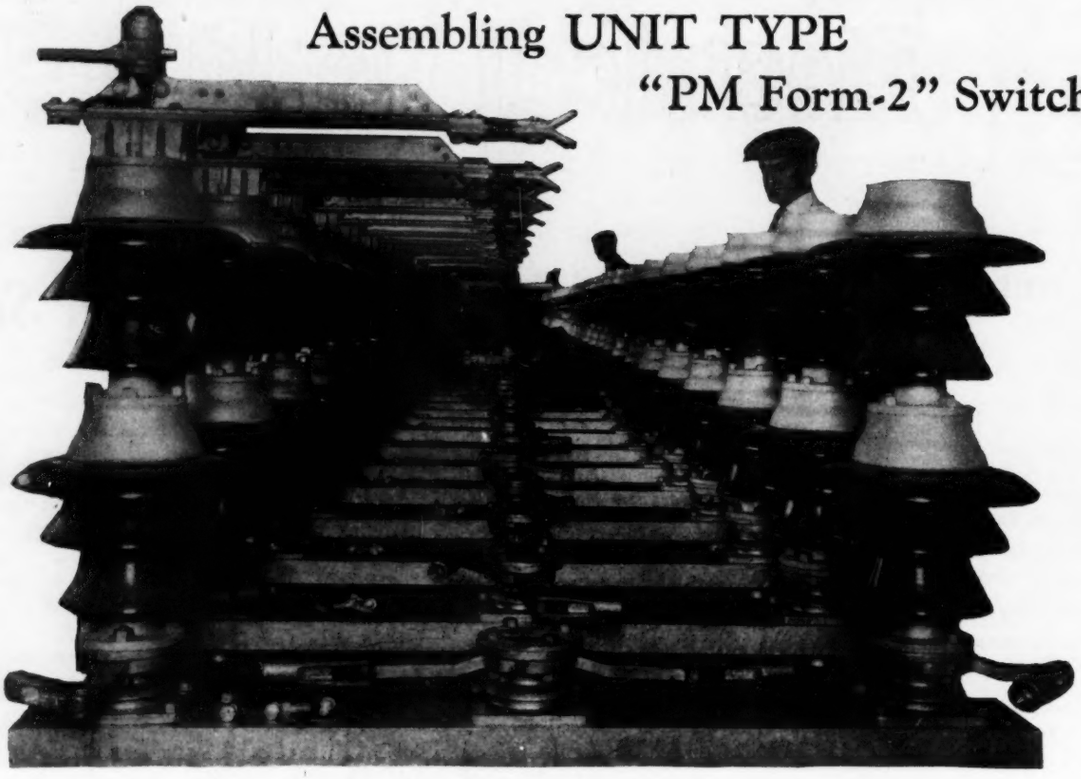
Assembling UNIT TYPE "PM Form-2" Switches



WHEN the tailor delivers your new suit— do you hunt up the needle and thread *and* sew on the buttons? Should he merely attach a bag of buttons and assume you would do this, you would send it back and make him do the job right.

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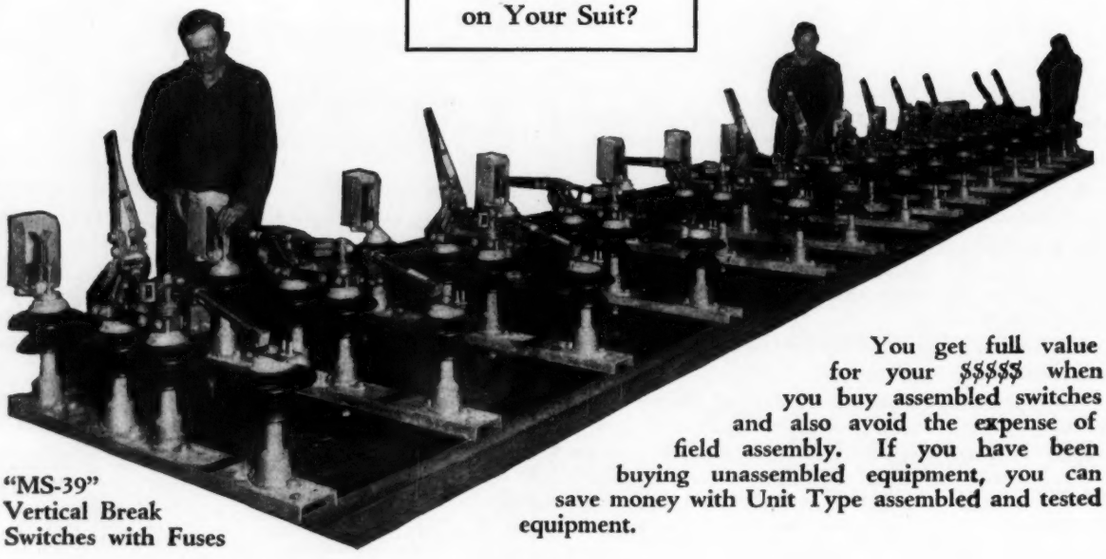

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 90 — *New York, Saturday, December 10, 1927* — NUMBER 24

Put Research Into Budgets

ELECTRICAL development bristles with interrogation points whether viewed from the economic or the scientific side. The industry progresses through the application of natural laws to the needs of mankind by research workers and engineers co-operating for the common good. Every operating company is a potential laboratory as well as a commercial enterprise, and its research value increases with the years. In the past economic limitations have too often prohibited creative investigations on "bread-and-butter" properties, but a new era has dawned. Never have the American people been so aware of the value of research as today. Well-directed publicity has thrown open laboratory doors; medical schools and astronomical observatories are offering popular lectures upon their achievements, and trade organizations are touring electrical manufacturing plants and getting new conceptions of the equipment and personnel required by modern progress. The scientist and the engineer may look upon spectacular experiments and demonstrations for the edification of laymen as a species of vaudeville, but popular interest in electricity has been created in many ways and should be capitalized for the benefit of true research.

It is a safe estimate that a reasonable appropriation for research from now on in public utility budgets will receive the approval of the great majority of stockholders, and that the employment of more research ability even in some of the larger companies will not be questioned if the management takes this step with real vision. Out of daily routine come innumerable opportunities to investigate problems whose solution contributes to the enduring welfare of the industry and those whom it serves. Here is a brilliant chance for centralized management to win new laurels or for the single company to follow up leads hitherto blocked by lack of organization, funds or managerial sympathy.

* * * *

Facts Govern Power Generation

WHETHER steam power or water power should be used to generate electrical energy in any region is not a matter of sentiment. It is a question of economic facts and much "bunk" about water-power development and long-distance power transmission can be eliminated if a few calculations are made. Water-power development should be encouraged, but not to the extent that means economic losses and not to the extent where the public is led to believe it is a gift of nature.

Because of recent improvements in the economics of steam-plant installation and operation many examples may be had which show that all water powers are not economic projects. As a sample of such calculations, assume that a steam station of large and modern type in a load area costs $100 per kilowatt and operates at a total operating cost of 3 mills per kilowatt-hour. This gives a fixed and operating charge of about $40 a kilowatt-year. Assume also that a hydro-electric project 100 miles away is to cost $150 a kilowatt, a transmission line of 30,000 kw. capacity at 100,000 volts costs $20,000 per mile, a right-of-way costs $5,000 per mile and operating costs are 1 mill per kilowatt-hour. These rough figures give a yearly charge of about $44 per kilowatt-year for the hydro power when delivered to the load. Calculations will vary with the data used, but it is fairly easy to reach a fair degree of accuracy for a particular project. It is good business to try a few cold figures on the rosy mists surrounding the ideas of those whose business it is to promote water-power development. It must not be forgotten also that maximum efficiency has been approached in the transformation of hydraulic power to electric power. Efficiencies of 90 to 93 have been reached. In the generation of electrical energy from fuel the corresponding maximum figure is about 25 per cent; but developments are even now under way which should increase this efficiency very greatly.

Cost figures of this type, together with the cost of reliable service over exposed transmission lines, should be considered when contemplating water-power developments for the purpose of supplying cities situated at a distance from the power plant. Generalizations should not be made, and in measuring its economic possibilities each project should be subjected to cold-blooded analysis.

* * * *

The Seventieth Congress

PARTY politics, always, naturally, the mainspring of congressional action, becomes almost the "whole works" in the session preceding a presidential election. To say this is not to indulge in cheap abuse of our senators and representatives, but merely to assert that they are human and that ours is a government by party. In the present session, as in every first session of an even-numbered Congress, every bill introduced and each motion made will be scanned by Republicans and Democrats alike for its political implications. Not only the personal fortunes of sitting members but the fortunes of actual and potential candidates for the Presidency inside and outside Congress, as seen by timorous supporters, will be held to be at stake. Political ambition is honorable, but it is the father of opportunism, and opportunism in a democracy, whether it take the form of discretion, that reputed better part of valor, or of playing loudly to the gallery, will bear watching.

The electric public utility industry is naturally concerned with some hold-over legislation from the Sixty-ninth Congress. Three major measures will be introduced early in this session; but the more closely two of them are scrutinized—the Muscle Shoals and Boulder Canyon bills—the more dubious their passage unamended appears. It is the Walsh resolution that seems to be most dreaded, however—not because of its effect on the elec-

tric light and power industry as a whole, for the industry will bear scrutiny, but because of its effect on the utility security market.

Of all the industries of the country, the electric light and power industry has been foremost in selling securities, as a matter of policy rather than as a matter of necessity, to its customers and employees. In some cases as much as one-third of all the money expended on new developments during the past five years of unprecedented growth has been raised by that means. A large part of the securities has been bought on installments, and now hundreds of thousands of people of modest means who have been taught thrift by the power companies are to have their faith in the value of their securities sorely tried. The value is there, and many knowing persons are accumulating funds with which to scoop in the securities of sound electric light and power companies as soon as their frightened owners are ready to part with them at a loss.

Ninety-five per cent of the electric light and power industry is above reproach, and were the inquiry proposed by Senator Walsh to be exhaustive instead of political in character, the result would be the finest commendation any industry could receive. But, unfortunately, it is the five per cent that will be sought out and magnified—the dross which every successful and well-meaning industry accumulates. The electric light and power industry has tried by honorable means to rid itself of these undesirables, and if Congress can do so by means of an inquiry, without hurt to the credit and stability of an industry which is everywhere regarded with admiration, more power to it.

* * * *

Transition in Labor Handling

TWENTY years ago the "old-school" construction men were much in evidence. They were more often than not a "rough and ready" lot. In those days it was usually the man who possessed the energy to rush about shouting his orders, as well as the vocabulary to swear more loudly and more fluently than his associates, who, if he had a reasonable amount of ingenuity and common sense, was considered the best construction man. Today much of this old order has been changed, and the "new school" of construction men are of the "leader" rather than the "driver" type. Much progress has been made in twenty years in the art of engineering and construction. The present work requires science and skill in the field as well as in the engineering office, yet many of the "old school" construction men are still on the job. They are making good with the new methods and ideas simply because they have changed their tactics and advanced in keeping with the requirements of the "new school."

The modern construction man uses his brains and experience most, reserving the energy formerly expended in noise and ill-advised violence. He is cool under fire, calm in the face of adversity, and he controls his men through their respect and confidence in him more than through any element of fear. Successful construction operations are carried out today by organization and team work, yet they require every bit as much as formerly the strong, aggressive personalities, optimistic dispositions and undaunted spirits that can win out in the face of supposedly insurmountable problems and irreducible obstacles.

Normal Growth Alone Is Not the Commercial Objective

"IT IS not enough to exceed last year's sales. It is the rate of increase that counts." Cogent words those—uttered by Frank A. Coffin, sales manager of the Milwaukee Electric Railway & Light Company, before the recent Commercial Section meeting of the Wisconsin Utilities Association. His remark, which was made in defining the commercial man's responsibility and objectives, turns the spotlight on a psychological quirk of some utility sales activities. Too often there appears a placid satisfaction with the year's new-business results if they but show a modicum of increase over those of the year previous. Normal increase will take care of that. It is the sales department's duty to accelerate the rate of this increase. If the central-station industry ever expects to get into the full swing of its commercial development program, it could well base it upon Mr. Coffin's aphorism: "It is not enough to exceed last year's sales. It is the rate of increase that counts."

* * * *

132,000-Volt Cables

AMONG many high spots of interest at the recent regional meeting of the American Institute of Electrical Engineers at Chicago, probably the most striking was the symposium devoted to descriptions of the design, installation and continued operation under load of two 132,000-volt commercial lines. The first of these, at Chicago, is a direct application of the plan of connecting a generating plant in the city to an outside overhead line six miles away, thus eliminating the usual substation for such a connection. The New York installation is twelve miles long, at present supplying the heavy load of the County of Westchester. Both have been in operation for several months under large loads. When it is remembered that it is only a few years since the successful operation of cables at 66 kv. was considered a marked step in advance, it is not surprising that this last step, which doubles the 66-kv. figure and which is presented to the profession, not as a promise, but as an accomplished fact, should have been received with enthusiasm and mutual congratulation.

It is interesting to note that the very satisfying presentation of the design of the cable by Mr. Emanueli assumes at once that the vital problem of design is that of complete elimination of internal gas voids, causing ionization, through the means of complete impregnation. There is almost entire absence of reference to other features of cable design, except in so far as they are related to the method adopted for conserving at all times an original thorough state of impregnation of the usual type of paper insulation. At first sight the problem of keeping full of oil at all times a central tubular channel in the cable conductor seems relatively easy. As a matter of fact, however, in reading Mr. Emanueli's paper one quickly realizes that this has constituted the most serious problem of the design. The oil must flow easily and quickly, following changes of temperature resulting from changes of load, without undue elevation of hydrostatic pressure at any point in the cable. These considerations, with others of similar nature, arising from the usual inequalities of the profile of a long cable line, lead to the necessity for intermediate oil-feeding sources between the extremities of the cable. When it is re-

membered that the oil in this flow-and-return system must at all points be carefully protected from leaks and from contact with the air, it will be realized how successful and striking the engineering accomplishment indicated by these two installations of major type is.

The economic and operating advantages obtainable with such high-voltage cables are the saving of intermediate substations, transformers, switchgear, reductions in the number of cables, saving on synchronous condensers and other similar factors. Mr. Torchio points out that the relative value of this saving will not be available until the ultimate carrying capacity of the oil-filled cables, as compared with those of earlier type, is known. In the discussion at the meeting attention was called to the elaborate nature of the cable installation, and its consequent expense, as offsetting some of the advantages mentioned. A subsequent tour of inspection of the Chicago cable did not, however, entirely bear out this estimate of the importance of these factors. As installed the terminal towers and intermediate feeding points are of quite simple construction, and bearing in mind the magnitude of the load being handled, they do not apparently constitute an unduly large element of cost.

It is also interesting to note that several times during the meeting there was confident mention of 220 kv. as an early next step for underground cables.

* * * *

Interest in Customer Ownership Must Not Languish

POWER company executives seem to be turning their backs on "customer ownership." Not so many years ago the industry was agog over this idea. And it was a good idea—probably the most constructive single contribution that has been made to the improvement of public relations. It opened up a new source of capital, yes, but above all it linked the customer to the utility company with a new bond of self-interest. It proved itself effective in countless cities. But today there seems to be a trend away from the sale of junior securities to the customer and a drift back toward the former practice of financing new security issues through the banking houses in the money centers. Why?

It is undoubtedly easier to rest the burden of finding money upon the shoulders of the bankers. It is simpler to sell bonds. It may cost a bit less. But the lessons of customer ownership should not be forgotten, for there is more than the mere cost of selling to be considered. When bonds are sold in a distant market they produce capital at a price. But when preferred stocks are sold at home to the consumers of electricity they produce not only capital but good will—and good will has a cash value no less important. And there is a question whether in many instances these customer issues of preferred stock have not cost more to sell than really was necessary. For so great has been their popularity in certain localities that issues have been ridiculously oversubscribed—ridiculous because an issue is only oversubscribed when it is a bargain. And a bargain is something sold below its market value.

The lure of cheaper money is naturally and properly strong. But the collateral benefit of customer ownership must not be forgotten, no matter how old a story it may become. The shoe merchant is undoubtedly tired of talking shoes. Shoes are an old, old story to him. But he knows that to his customers who come into the store to buy shoes are at the moment of consuming interest, and so he must expound the good qualities of shoes day after day throughout each year. So it is with customer securities, and the men responsible for financing the expansion of the power industry should not permit the interest in the sale of stock to their own customers to languish. The maintenance and expansion of this financial copartnership with the public is of vital value to the industry.

* * * *

Energetic Sales the Best Answer to Criticism

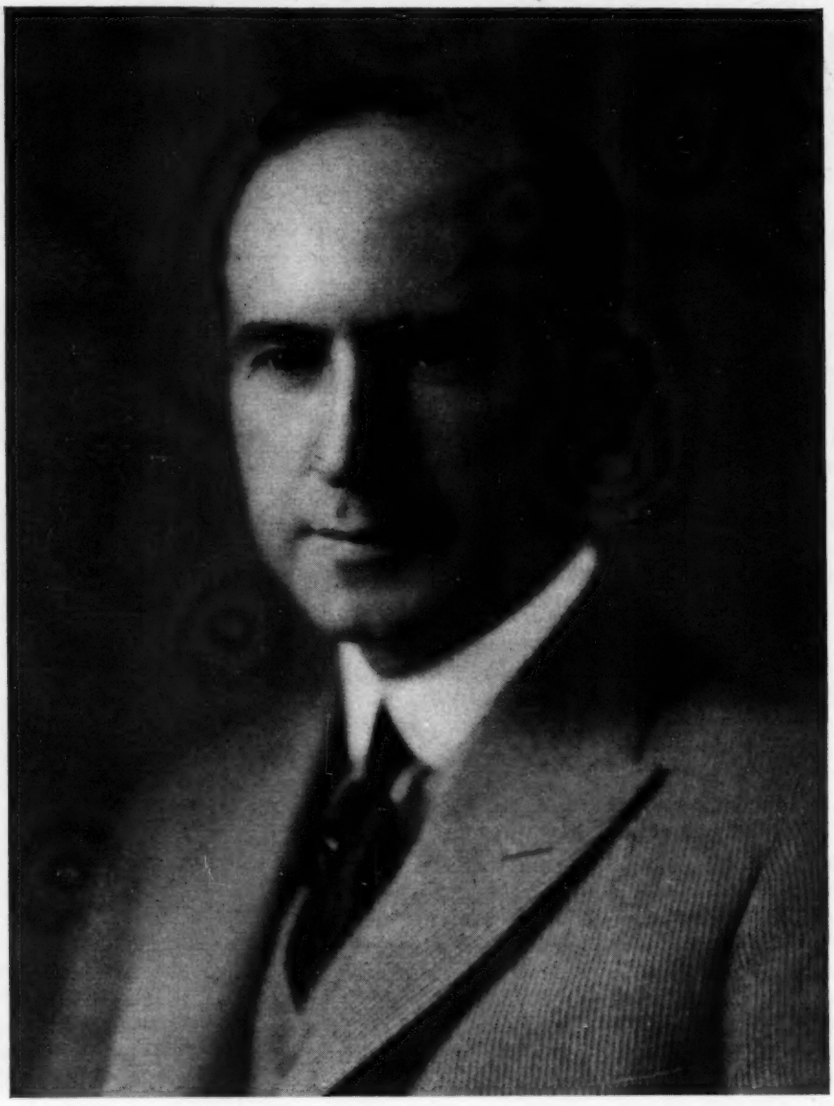
MILITARY strategists long ago discovered that attack is the best form of defense. Fundamentally, the offensive position is stronger. It signifies high morale, confidence, aggression, advantage, better generalship—all of which spell success or victory and attract new followers and adherents. In the commercial world no less does this principle hold good. That industry which goes along in a listless way, confident of its impregnable position, is essentially on the defensive. It is potentially subject to attack and may be riding for a fall. On the other hand, that industry which is constantly on its toes, carrying out energetic sales programs, advertising its wares widely to the public, introducing new models or refinements of its product and improving manufacturing methods, is bound to go ahead. It attracts new adherents with every successful sale, and each new customer becomes an ally and remains one so long as the industry maintains its aggressive attitude. There is no better measure of a company's or an industry's success and standing with the public than its sales volume. Truly, nothing succeeds like success, and it is human nature for people to want to be good customers of a large and going concern.

It is particularly fortunate and opportune that an industry-wide selling program is in the making at this time. The pending federal investigations of the utility companies have been aimed, with the politician's aptitude for psychological effect, to put the power companies figuratively on the defensive. In this the advocates of government ownership have been but partly successful as the forehanded utility industry is already laying its cards face up before the court of public opinion. But of equal importance is the industry sales program. No better indication of the electric utilities' strength of position could be had than their decision to embark upon an energetic sales campaign. It shows a degree of self-assurance and aggressiveness that begets confidence in the minds of customers and the public. No business not absolutely on the level would have the temerity to engage in a national selling project. It could not risk the consequences of adverse public opinion.

In planning and carrying on an energetic sales attack the utility industry will accomplish a threefold objective. First, it will add much desirable new business; second, it will make new friends of its new customers and strengthen its relations with existing customers; third, it will in effect launch a strong counter-attack against political attempts to place it on the defensive. Commercial men have right now a greater responsibility than ever before in the history of the central-station industry. Not only must they perform their usual duties in building additional load and new business, but in performing this function they are at the same time carrying out a major attack against those who would jeopardize the welfare of the industry.

Fred Bradley Lewis

An engineer who combines financial with technical ability and thus gets results in two fields.



A HARD worker and keen thinker, driving always toward a single objective and possessing unusual financial ability, Fred B. Lewis has risen through the ranks of the Southern California Edison Company to the position of assistant general manager. He has never been identified with spectacular happenings, but rather has worked steadily toward a goal.

Mr. Lewis first came into prominence in 1924, when he filled the position of power administrator for the Southern California Edison Company during the power shortage of that year, and it was largely due to his unusual administrative gifts that this emergency was passed with so little inconvenience to the public and so little curtailment of industry. Soon afterward he was promoted to the position he now holds. Since occupying this post he has inaugurated a system of budgeting all operating expenses by which every department in the company is kept within the limits set and it is possible to forecast nearly a year in advance what the financial statement will look like at the end of the year.

Born in southern California, Mr. Lewis was greatly interested and perhaps inspired as a young boy when he read about the building of what was then a line of extremely high voltage by the Southern California Edison Company to transmit power from the Santa Ana River to Los Angeles. Two things were impressed on his mind—first, that this company was making history in the electrical industry; second, that the electrical industry attracted him more than did any other as a field in which he could do his life's work.

After graduation in electrical engineering from Rose Polytechnic Institute, Terre Haute, Ind., in 1905, he obtained a situation with the Southern California Edison Company, and he has been with that company ever since, occupying the posts of engineer of underground distribution, superintendent of the Los Angeles district, manager of operation, and since September, 1924, assistant general manager. As chairman of a power committee composed of representatives of all the power companies of the state Mr. Lewis had an active part in the work of interconnection which has now knitted the physical systems of the California companies from the Oregon line to Mexico and has been of inestimable value to consumers.

Analysis of System Conditions*

As They Affect Current and Future Operation in New York

By JOHN W. LIEB
Vice-President and General Manager The New York Edison Company

A study of load durations, other utility load characteristics, seasonal and weather effects, output, demand, load and coal consumption trends, load densities and system layout

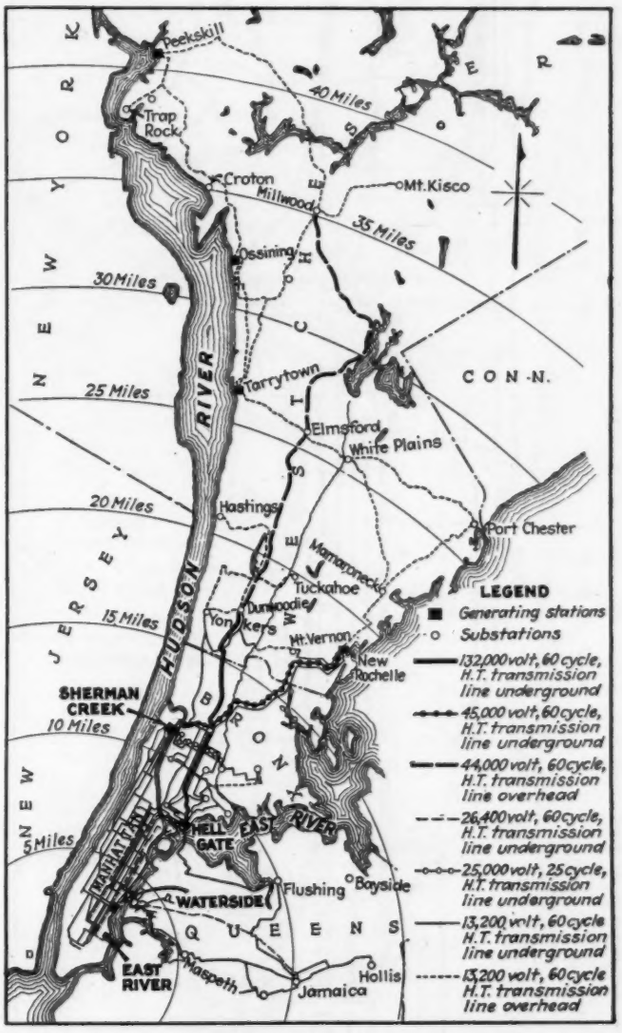
DURING the past ten years the energy generated by the New York Edison-United systems has increased threefold, and there appears to be no diminution in the rate of increase. One might suppose that in the intensely developed parts of Manhattan the requirements for electricity supply would be saturated, but such is not the case, as the continual creation of new applications for electricity and the increase in the size and height of the building units provide an ever-increasing demand at the fairly uniform rate of 10 to 12 per cent a year. In the Borough of the Bronx, however, the increase is at the rate of about 20 per cent per year, in Westchester County about 19 per cent, and in Queens the demand is increasing at the rate of nearly 22 per cent each year! Thus it is seen that the problem of providing for the increased demands for electric service in New York is as pressing as ever and the necessity of forecasting the probable future demands of the several districts becomes increasingly important, owing to the constantly growing quantities with which we have to deal.

Load factor is gradually improving, the rate of improvement reflecting the increasing diversity of uses to which electrical energy is applied. It has a little more than doubled since the early days of electric service, thus showing a large improvement in the average use of the equipment, resulting, of course, in a decreased cost per unit of electric service.

Although the load factor is the most important load characteristic, it is also important to know the minimum loads and maximum loads, with the load distribution between these limits. These characteristics are shown for the year 1926 by the "duration curve." In it are the elements for any discussion of the economics of power production and the basis for any comparison that may be made between the cost of transmitted hydro-electric power and steam power.

From the early days the general characteristics of demand for electric service have continued. Human nature has remained much the same as have the recurring hours of dawn, daylight, dusk and night.

From 1916 to 1926 the maximum demand has considerably more than doubled. The loads on the combined New York system have the same general characteristics as those on the direct-current system, except that the proportionately larger residence service outside

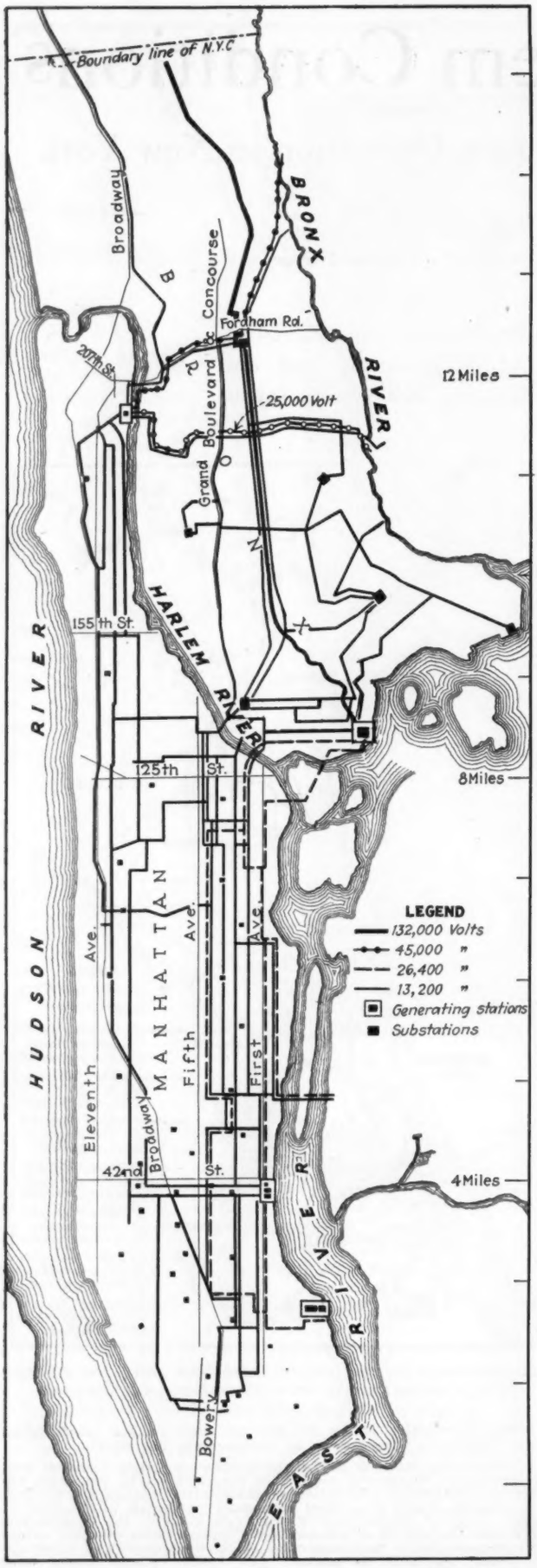


TRANSMISSION SYSTEMS (13,000 VOLTS AND ABOVE) OF ELECTRIC COMPANIES AFFILIATED WITH CONSOLIDATED GAS COMPANY OF NEW YORK

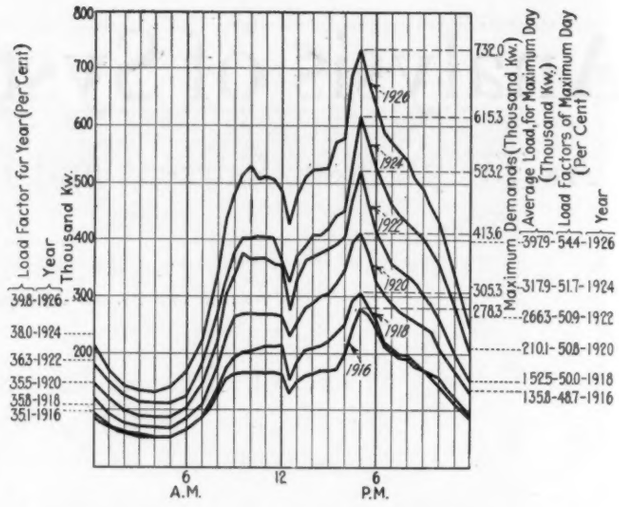
The exact route of the 132,000-volt underground cables from Hell Gate generating station to Dunwoodie is not shown.

[Interesting features of this installation, including terminal and intermediate equipment, method of installing cable, preparing oil before installation, evacuation of cables after installation, method of making joints, etc., were pictorially presented in the Oct. 8, 1927, issue of ELECTRICAL WORLD. In general, the installation involves the use of single-conductor, hollow-core, oil-filled cable, oil pressure being maintained by elevated reservoirs at intervals between terminals to prevent gas voids. About every mile throughout the run are stop joints which permit electrical continuity, but sectionalize the oil.—EDITOR.]

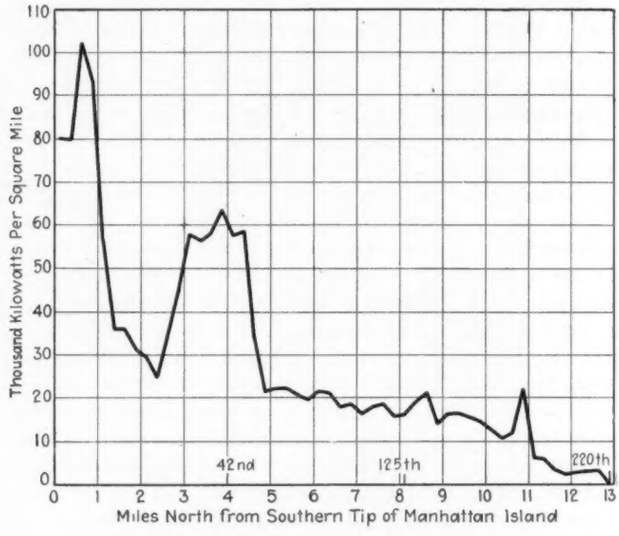
*Excerpts from address before New York Section of A.I.E.E. on Development and Future of Central-Station Service in New York City.



RELATIVE POSITIONS OF SUBSTATIONS AND GENERATING STATIONS

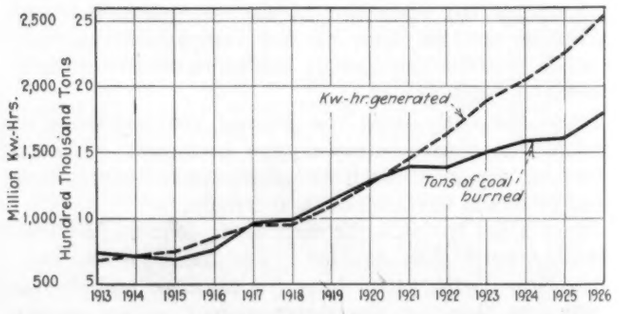


GENERATING-STATION LOAD CHARACTERISTICS FOR MAXIMUM DAY OF YEARS FROM 1916 TO 1926. (NEW YORK EDISON-UNITED AND ALLIED COMPANIES' SYSTEMS)



LOAD DENSITIES IN MANHATTAN (1926)

From the Battery to 135th St. electric service is supplied largely from low-tension direct-current mains and in part from the alternating-current distributing mains. To the north of 135th St. all supply is from alternating-current mains. In the area between 35th and 39th Sts., and Seventh and Eighth Aves. the load density is no less than 257,000 kw. per square mile. For the dense-load sections, such as in the southern part of Manhattan with its imperative requirements for absolutely unfailing and continuous service, Mr. Lieb believes that there is no system of electrical distribution in existence that could provide the service as perfectly as the system in use.

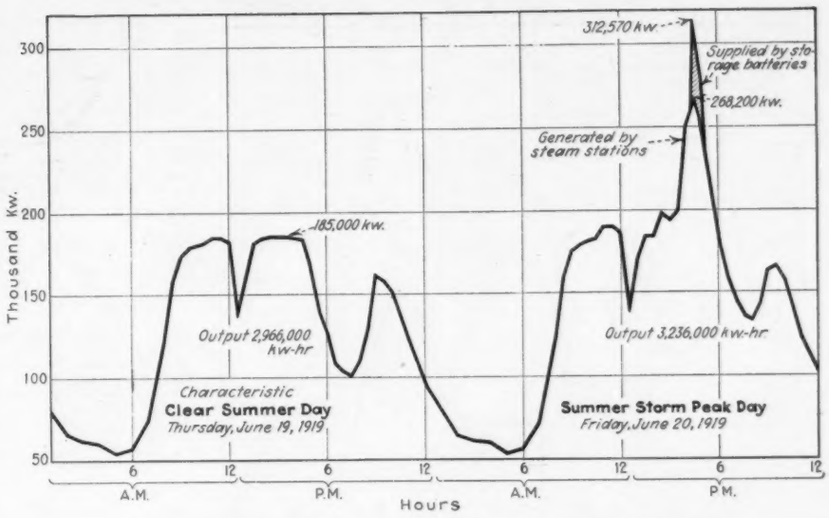

Million Kw.-Hrs.
Hundred Thousand Tons
Kw-hr generated
Tons of coal burned
1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926

OUTPUTS AND COAL CONSUMPTION OF THE NEW YORK EDISON-UNITED COMPANIES FROM 1913 TO 1926

The quality of coal received during the war is clearly reflected in this chart. Although the output of generating stations is shown increasing very rapidly, it will be seen that the total tons of coal burned increase at a much slower rate.

of Manhattan provides a relatively higher load after the peak period, extending into the evening. In both cases the maximum or peak load regularly arrives with mathematical certainty at 5 p.m. With everything that can possibly be done to improve the load factor of the system, this condition of a very high peak load at 5 p.m. on the dark winter evenings will continue to prevail in New York City, so far as we can now see, considering the way in which the city is expected to grow.

The accompanying comparison of the loads on several kinds of public utilities is a most interesting epitome of the habits and customs of the people, as reflected in the demands they make for the various kinds of public utility service. The effect on the load curves of daylight saving, the progressive movement through the city of a great parade (such as during the Hudson-Fulton celebration, the Dewey parade, etc.) and the incidence of special holidays are cases in point. Recently there was a most interesting illustration of the effect on the lighting and power load curve of the recent Tunney-Dempsey fight at Chicago. (See ELECTRICAL WORLD, page 746.)



RELATIVE GENERATING-STATION DEMANDS FOR CLEAR SUMMER DAY AND STORMY SUMMER DAY (NEW YORK EDISON-UNITED AND ALLIED COMPANIES SYSTEM)

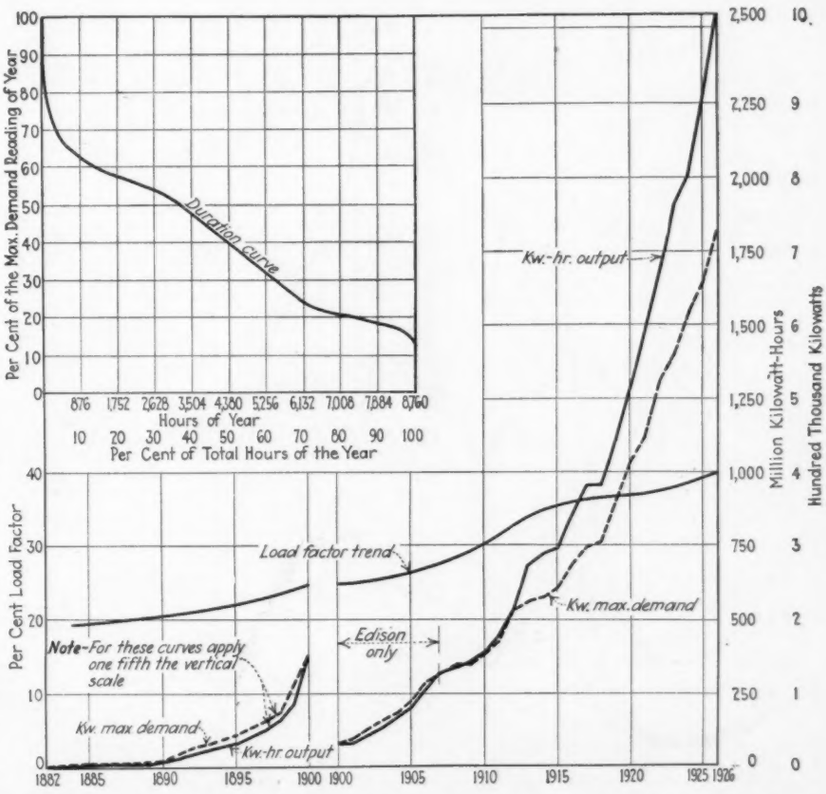
Some appreciation of the effect of seasonal changes on load is afforded by the accompanying contour curves. Although the winter day produces a somewhat heavier load during the entire 24 hours than the other days, nevertheless the alpine peak at 5 o'clock reduces its daily load factor to two-thirds or three-quarters of the load factors of the other days.

Summer is usally the only time when the large units of equipment may be withdrawn from service for thorough overhauling and repairs, which require from three to six weeks for each large unit. But this possibility is made difficult by the very black storms that arise on clear days in midsummer. Thus even in midsummer the electric service companies must be prepared to care for sudden increases in load rising to as much as the highest previous maximum load.

The effect of one of these extraordinary storms is illustrated wherein the demand within the brief space of an hour rose to two-thirds greater than would normally be expected on a clear summer day and exceeded any previous maximum demand on the system. Although such an occurrence as this is unusual, still the power stations must at all times be in a position to take care of such contingencies.

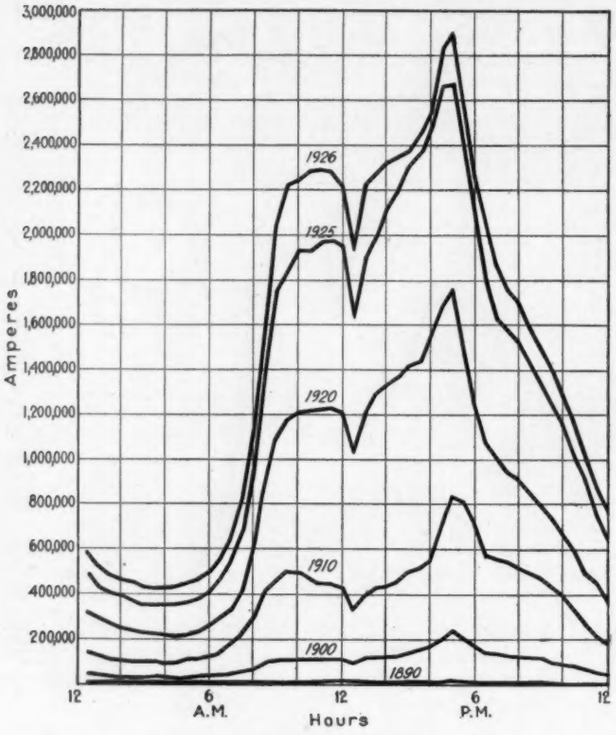
Owing to the extraordinary size of generating stations now being constructed and the great size of electric generating units being used, it becomes important to have increased steam boiler capacity per square foot of floor space and per unit of cubic contents. Therefore the boilers in the East River station have five or six times the early ratings of steam boilers, and in the not-distant future the capacity per boiler may be increased to ten or more times the former ratings.

The New York metropolitan district alone requires more than five and one-half billion kilowatt-hours yearly and creates a power demand of more than one and one-

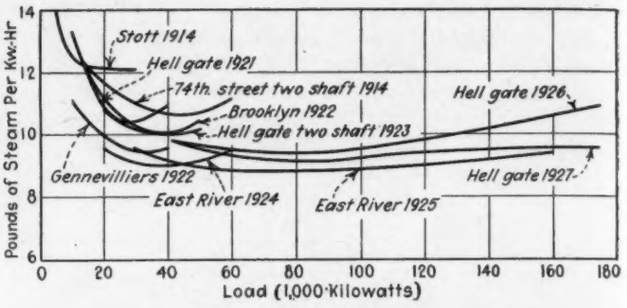


UPPER LEFT—DURATION OF THE COMBINED LOADS. AT RIGHT—CORRESPONDING OUTPUTS AND MAXIMUM DEMAND, SHOWING TREND OF LOAD FACTOR

Fifty per cent of the load is carried 3,241 hours, or little less than 40 per cent of the year. The generating stations, transmission system and distribution system are called upon to provide the top 25 per cent of the maximum load for only 175 hours throughout the entire year. The minimum load, which is roughly 93,000 kw. and only about 13 per cent of the maximum, is carried through the entire 8,760 hours of the year. Curves apply to the New York Edison, United Electric Light & Power and their allied electric companies.

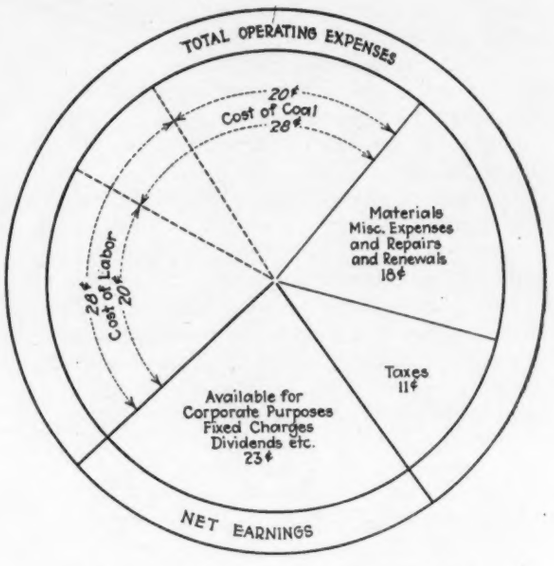


DIRECT-CURRENT LOAD CHARACTERISTICS FOR MAXIMUM DAY OF YEARS FROM 1890 TO 1926. (NEW YORK EDISON COMPANY)

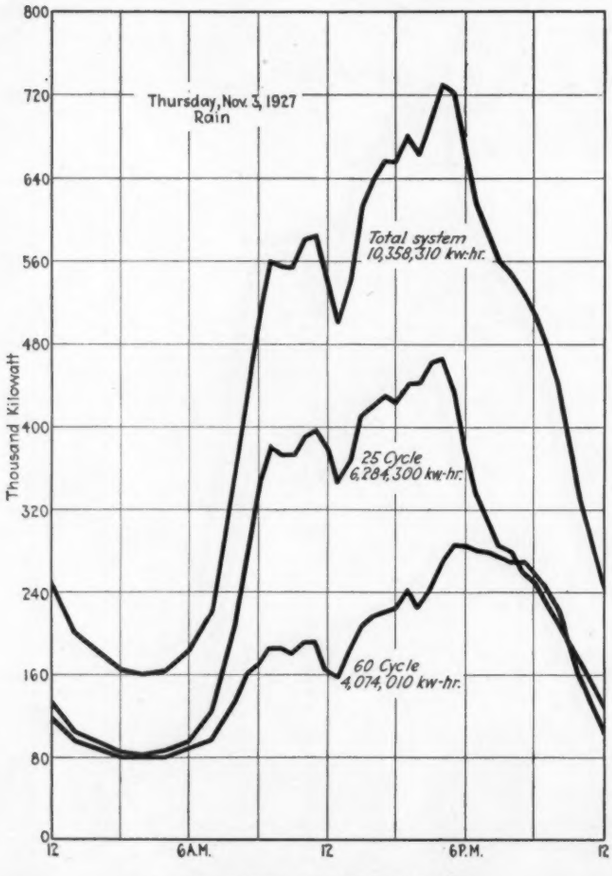


COMPARATIVE STEAM RATES OF TURBO-GENERATORS

Although the largest units now installed are rated at 60,000 kw., no less than three 160,000-kw. turbines have been ordered to be ready for operation in 1928.

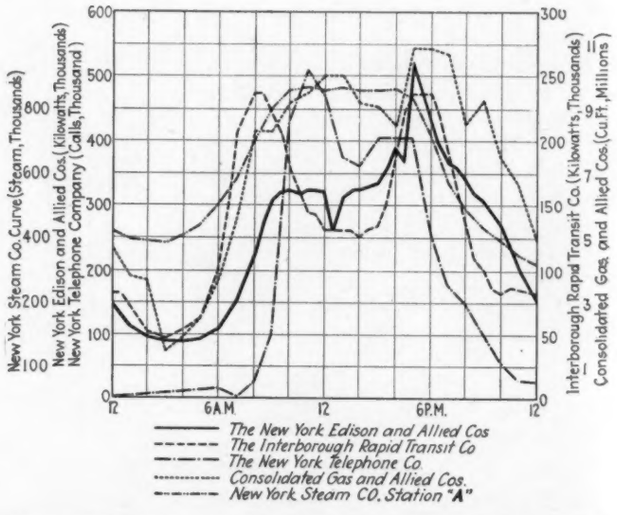


TYPICAL DISPOSITION OF INCOME DOLLAR



A PEAK CAUSED BY RAINY FALL DAY

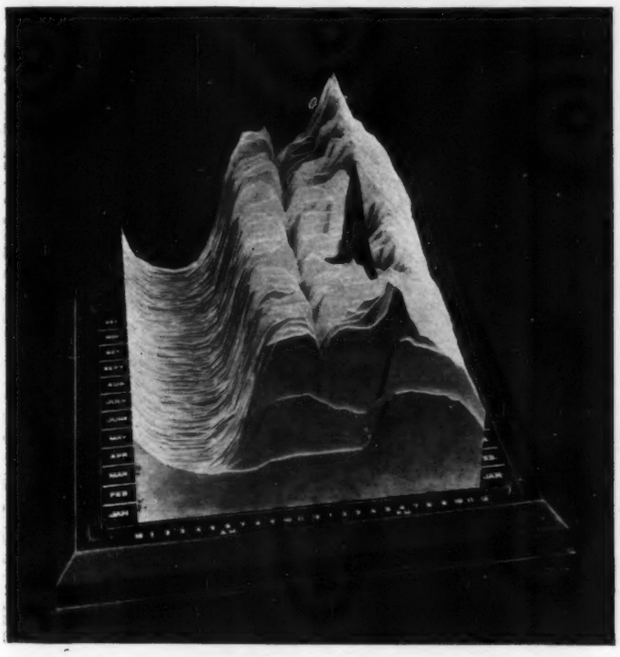
The output on this day alone was 10,358,310 kw.-hr., compared with the maximum day of 1926 — Dec. 20 — with an output of 9,549,838. The load factor for the day was approximately 60 per cent. Curves show combined performance of New York Edison, United, Westchester, Queens and Bronx companies.



COMPARATIVE DAILY LOAD CURVES OF TELEPHONE, LIGHT AND POWER, TRACTION, GAS AND STEAM HEAT UTILITIES

The electric utility has its tremendous peak at 5 o'clock. The traction load becomes heavy at 9 o'clock in the morning, to bring people to their business; then again in the afternoon, about as high as the morning peak, but broader. The telephone system has its heaviest load at 11 o'clock in the morning, with a very small and insignificant load during the night. The maximum gas load occurs at 5 o'clock in the evening, as with the electric lighting, and extends well past the peak of the lighting and power load. In the case of steam heating, the heavy output comes on fairly early in the morning, keeps pretty steady throughout the day, and then it falls off to a lower load, which continues relatively uniform during the night.

half million kilowatts. With 12½ per cent annual increase, the installation of nearly 200,000 kw. of additional plant capacity will be required annually. In the period of five years the number of customers served from the combined system of the New York Edison-United and allied electric companies has multiplied two and a third times. At present the customers number more than one million and a quarter and require more than 1,300,000



YEARLY CONTOUR OF DAILY LOAD CURVES OF THE EDISON AND ALLIED COMPANIES

The effects of a holiday, a Saturday, a Sunday and also the effect of an extraordinary summer storm on the station load are shown. At the very start is the holiday load of Jan. 1, then comes that of the Saturday immediately following, and then follows the Sunday load, which is hidden in the illustration. The high black tongue shooting up in the central portion indicates a typical sudden summer storm load, for which generating stations must be prepared at any time during the summer.

A high peak occurs at 5 p.m. on the winter day. The fall day has about the same morning load as the winter day, dropping down for lunch time and quickly returning to approximately the morning load, then dropping down on account of the cessation of power and the business lighting, and coming back again to the highest peak at 7:30 in the evening. This peak gradually drops off to the regular night load. The spring day is not far different in its general characteristics from that of the fall day, and the summer day, with the long clear evening, shows a very great reduction in the evening load until after 8 o'clock, when the dusk deepens and brings the load up again. The fall, summer and spring days would show the loads coming on an hour earlier in the morning and an hour earlier in the evening were it not for daylight saving.

meters. During 1926 alone there were added nearly 200,000 customers, an increase of more than 16 per cent.

The price for coal during the next ten or twenty years is one of the least readily predictable elements entering into the supply of electrical energy and naturally has considerable bearing on the question of the practicability of bringing hydro-electric power to New York City over long transmission lines from Niagara Falls, the St. Lawrence or Canadian points.

OUTPUT AND MAXIMUM LOADS OF POWER AND TRANSPORTATION COMPANIES IN GREATER NEW YORK AND WESTCHESTER COUNTY (1926)

	Electric Lighting and Power Companies	Transportation Companies	Totals
Maximum loads on generating stations (kw.)	988,000	580,810	1,568,810
Output of generating stations (kw.-hr.)	3,187,000,000	2,331,387,000	5,518,387,000

YEARLY OUTPUT OF GREATER NEW YORK AND NEW JERSEY PUBLIC UTILITIES (1926)

Companies	Output, Kw.-Hr.
New York Edison and allied companies	2,313,000,000
Brooklyn Edison Company	874,000,000
Public Service Corporation of New Jersey	1,377,550,000
Total light and power	4,564,550,000
Interborough Rapid Transit Company	1,062,921,000
Brooklyn Rapid Transit Company	536,716,000
Public Service Corporation of New Jersey	194,000,000
New York Edison and allied companies	183,000,000
Total street railway companies	1,976,637,000
New York Central Railroad Company	205,600,000
Pennsylvania Railroad Company	280,150,000
N. Y., N. H. & H. Railroad Company	57,000,000
Total railroad companies	548,750,000
Grand total	7,089,937,000

Whether it will be economically possible to deliver hydro-electric energy from external sources to the metropolitan district, under its extraordinary power market requirements, is one of the important questions that the future alone will solve. But of one thing we are certain—that before many years roll by there may be considerable blocks of this power brought into the metropolitan area, and that there will be interconnections between all the great power-generating systems of the metropolitan area and the surrounding territory, including the great sources of hydro-electric power to the north, so that relayed power to or from all of the vast area within transmission distances of Manhattan will become possible.

Reducing Distribution Losses

SECOND ARTICLE

Compilation of Loss Reports to Obviate Errors

By J. B. Moorhouse
Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.

A TRANSMISSION line company in preparing the monthly line loss report has an apparently simple problem, as follows:

Kilowatt-hours supplied, obtained by adding the kilowatt-hours registered in one month on all meters feeding the system, *less kilowatt-hours accounted for,* obtained by adding the kilowatt-hours registered in the same month on all meters over which energy is dispensed, *equals kilowatt-hours unaccounted for.*

(Kilowatt-hours unaccounted for ÷ kilowatt-hours supplied) × 100 = *percentage loss.*

Although apparently simple, the foregoing may involve several errors. Meter errors may exist; meters may be out of order; meter constants may be wrong; meter under-read or over-read; wrongly estimated in case the meter is not running; energy may be dispensed without metering; trial balance preparation may be done incorrectly; clerical errors may occur at any time.

To minimize the trouble with meters a first-class meter department is essential. This department should, at least, be headed by a man who is thoroughly conversant with all modern types of meters. He must also understand the theory of operation, testing, maintenance and repair of meters. Such questions as proper fusing of potential transformers or correct sizes of current transformers may be decided by the meter department,

giving consideration to the accuracy of the loss report as well as correctness of the billing of customers.

Should a meter stop running, it is necessary that an estimate of the energy consumption be made. Past records and a knowledge of present operation conditions are useful as a basis for estimation. The superintendent in charge of the affected territory is responsible for the correctness of the estimate.

All service should be metered. Cases may arise where service must be given without metering. A calculation or close estimate of the kilowatt-hours thus dispensed should always be made, rather than permit this energy to become a part of the unaccounted-for loss. Much territory is now served with electrical energy from loop transmission circuits, requiring the purchase of power at two or more points on an interchange basis. Accuracy in metering is here secured by the use of ratchet meters.

Trial balance preparation is responsible for other errors. A customer served from distribution system A may be billed from headquarters of system B for convenience of the customer. The customer's energy consumption must then be subtracted from the B's total sales and be added to system A. Neglect of the foregoing will introduce an error in the loss reports of the two communities involved.

Energy consumed in a power station that is in operation, or in substations connected therewith, is not included in the preparation of the report of line loss, since it does not pass over the transmission lines. Energy consumed for "station use" is therefore deducted from the total output of the power station. On the other hand, energy consumed in a station that is not operating must be included in the loss report, since it is supplied from the transmission system. A difficulty arises from stand-by stations that operate on a part-time irregular schedule; this necessitates special calculation based on station operating records or special provisions in metering.

Regulatory Commissions Urge Utilities to Maintain Public Relations

THAT the public utility companies of the country should use every reasonable effort to establish and maintain proper public relations was the suggestion of a committee of the National Association of Railroad and Utilities Commissioners, recently in convention at Dallas, Tex.

For the establishment of such relations the committee suggested the following procedure:

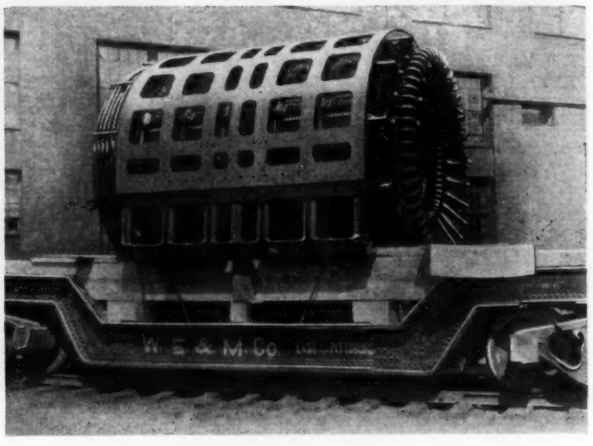
1. That the different utility companies faithfully and courteously fulfill all their assumed obligations to serve the public and consistently inform the public as a copartner in business on all matters materially affecting the service or in which there is a legitimate public interest.

2. That the public, as a copartner in the utility industry, should be enlightened by educational programs in schools, by the public press, by lectures, and by general authentic publicity information, on the fundamental principles pertaining to utility companies, their organization, operation, service and regulation, and particularly as to the vital importance of financially sound utility companies and the individual and public importance of the service they render.

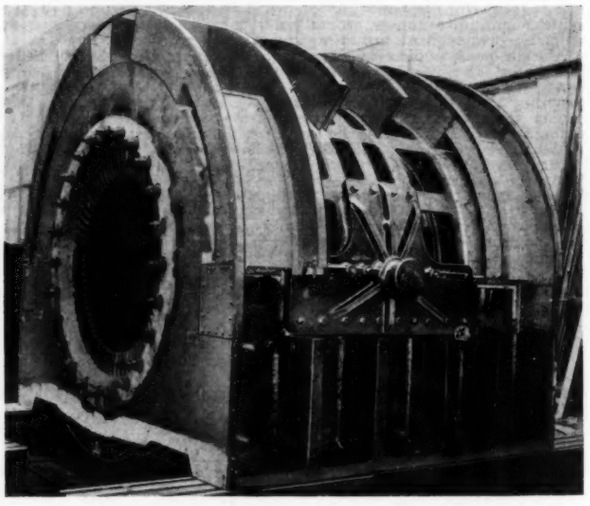
3. That regulatory commissions (a) use every reasonable effort to impress upon utility companies coming under their jurisdiction the necessity of good public relations and their duty in maintaining such relations, to keep their patrons honestly informed on all matters of legitimate personal interest in connection with their operation; (b) give to the public press all information of public interest pertaining to their duties and activities as regulatory bodies; (c) co-operate as far as possible with the educational institutions of the state in an effort to establish a carefully prepared study of public utilities, public utility companies and public utility regulation, in the public schools and colleges; (d) conjoin with other commissions in establishing standard rules of practice and procedure wherever practical and in co-ordinating the regulatory functions of the different state and federal commissions.

Generator Design Facilitates Handling

THROUGH the use of a skeleton frame construction, generators up to 94,000 kva., as made up by the Westinghouse Electric & Manufacturing Company, may be shipped completely built and wound. Machines are handled by cranes, using bolted-on trunnions, which may be removed for shipment. When installed, a steel superstructure is applied.



ASSEMBLED 35,300-KVA. GENERATOR AS SHIPPED ON MANUFACTURER'S CAR



REMOVABLE TRUNNIONS AID IN HANDLING OF ASSEMBLED GENERATORS

The advantages of shipping such machines, completely built and tested, include final skilled construction and testing at the factory instead of under less favorable conditions at the customer's partly finished power plant. Turbo-generators are also being built of welded structural steel instead of castings.

Control of Construction Costs

Detailed cost reports and "bogied" estimates lead to economies in construction of 150-mile steel tower line. Foremen rated according to results of labor charge analysis. Supervision simplified and efficiency improved

By O. W. GATCHELL
New York

DAILY labor cost reports by camps, semi-monthly summaries by the field office comparing actual costs against both item and mile line labor bogies and a monthly camp-rating report were features of the cost control used on a recent construction program of 150 miles of high-tension steel tower transmission line.

On this work the operating company ran location and secured right-of-way, the consulting engineers furnished engineering design and purchased line material and the construction organization handled all erection. Labor gangs worked from tent camps, moved along the line or reoccupied by succeeding gangs as required. A foreman, an engineering inspector and a timekeeper were stationed at each of the camps, which averaged from 30 to 60 men.

Each inspector made up the daily camp labor cost report shown in Table I, costs by accounts being obtained from the timekeeper's labor and team roll distribution sheet, plus a meal charge proration. Listing of work quantities and resulting unit costs completed the form. Copies of this report went to the camp foreman, job and general superintendents. The foreman, by reference to his bogy sheet, had an immediate check on his actual versus bogy unit costs, and the superintendent was kept familiar in a general way with the quantity and cost of work done by the various camps.

The daily sheets were summarized semi-monthly in a report for the entire line, prepared by the cost engineer at the field office. Direct labor costs were taken from the cashier's semi-monthly line distribution, which also carried a meal charge proration. Other labor costs, such as contract haul payments and office charges, which do not appear on the inspectors' reports, were included, together with the camp costs noted in Table I. Actual unit costs thus included all expenditures affecting labor cost of building line and were compared with office bogies. These bogies were higher than the field bogies on account of the additional expenditures absorbed. On beginning construction, the "estimated' cost per mile of line was obtained by adding the products of the average number of item units per mile of line, tower tonnage, cubic yard excavation, etc., times the item bogies. This "estimated" cost had only to be figured once unless structure list quantities were greatly changed during construction. The "actual" cost per mile of line for any item was refigured for each report, using the same average number of units by items, times the "actual-to-date" unit cost achieved. If work had not opened on some items, the estimated figures were used to complete the "actual" column. The semi-monthly analysis afforded the superintendent a quick comparison between the current and bogy labor cost per mile of line and pointed to changes in construction methods when important unit costs too greatly exceeded unit bogies.

BOGY ESTABLISHED BY BEST CAMP

If labor costs on the line report were not satisfactory, a question arose regarding the relative performance of the different camps on the same item of work. As many as five camps might be at work on the tower group of accounts, excavating footings, building straight up, and the like. To single out the weak foremen, a monthly camp cost rating shown in Table II was used, where the lowest unit cost established by any camp on standard items of work became the bogy. Only selected labor accounts and camp costs were watched. If one camp could score lowest unit cost on all items, its rating would

TABLE I—LABOR COST REPORT FORM

Account No.	Description	Unit	Period Actual			Actual to Date			Unit Cost Bogy	Per Mile Line		Remarks
			Quantity	Cost		Quantity	Cost					
				Total	Unit		Total	Unit		Actual	Estimated	
	Tower Group:			$	$	$	$	$	$	$	$	
	Hauling towers	Ton										
	Digging holes	Cu.yd.										
	Concrete footings	Cu.yd.	Camp inspector uses this space for reporting daily camp labor costs									
	Backfilling	Tower										
Accounts follow standard decimal classification of national associations	Tower erection	Ton										
	Conductor Group:											
	Hauling wire	Reel										
	Hauling and erecting insulators	Each										
	Stringing static wire	Wire-Mile										
	Stringing conductors	Wire-Mile										
	Camp lodging	Bunk night	All columns are filled in when form is used for semi-monthly line summary									
	Mess loss	Meal day										
	Moving camp	Move										
Total structure labor												

TABLE II—CAMP COST RATING REPORT

Camp Item	Unit	Camp No. 1 (4 Months)			Camp No. 2 (5 Months)			Camp No. 3 (3 Months)		
		Quant.	$	Rating, Per Cent	Quant.	$	Rating, Per Cent	Quant.	$	Rating, Per Cent
Hauling towers	Ton	346	1,466	95	185	748	100	25	126	80
Digging holes	Cu.Yd.	...	2,178	47	...	4,248	100	...	1,691	59
Backfilling	Tower	...	878	64	...	2,231	100	...	1,296	39
Tower erection	Ton	...	1,875	78	...	4,846	100	...	1,310	78
Hauling wire	Reel	...	720	100	...	166	83	...	....	...
Stringing static wires	Wire-Mile	...	2,020	100	...	....	...	...	720	...
Stringing conductors	Wire-Mile	...	2,380	100	...	...	...	...	860	73
Camp lodging	Bunk night	...	1,500	100	...	1,200	86	...	778	39
Mess loss	Man day	...	100	87	...	100	100	...	66	48
Moving camp	Move	...	1,190	100	...	1,156	69	...	514	77
Sum of item %'s × $			$12,328			$14,141			$4,526	
Sum camp expenditures			$14,307			$14,695			$7,361	
Camp cost rating				86			97			62

be 100. For each item of work the poorer camps were rated at the percentage below 100 arrived at by dividing their unit costs into the best camp's unit cost. The over-all camp rating was the ratio of sum of item percentages times expenditures, divided by total camp expenditures. All foremen were given a square deal, since the rating report covered enough time to average in any temporarily high cost occurring when any one camp encountered, for example, a short section of bad foundation conditions. Data for rating were already at hand, as the "to date" quantities and expenditures on the camp reports for the last day of the month required merely some adjustment for use. Each foreman's cost on camp operation, for which he was responsible, was also readily taken into account, since these figures were summed up in the camp-operating accounts on the semi-monthly line report, Table I.

Construction cost analysis interests a busy superintendent only to the extent that specific labor crews or construction items needing his attention are pointed out. The camp-rating report gave the superintendent a concise analysis of unit cost variations between camps. Such variations, when due to difference in the foremen's ability, are a big source of loss on the labor cost of line erection. That the rating report furnished a sound basis for judging camp foremen was demonstrated after several reports became available, when it was found that the cost rating of the different foremen ran quite uniformly. In fact, Camp No. 3's performance, as shown in Table II, ran so consistently bad that this camp foreman was dropped. A comparison of any foreman's unit cost with the best foreman's cost on the same item of work is, after all, closer to the facts than a comparison with the engineer's bogy, no matter how carefully the latter is estimated. Even with line construction proceeding satisfactorily, at less than the estimated cost per mile of line, it was found that variation between camps ran as high as 40 per cent on important item costs and 35 per cent on over-all camp ratings. With the permissible variation in camp performance held to 20 per cent by a rearrangement of the crews, a considerable saving in the total labor cost was indicated.

TABLE III—ANALYSIS OF TRANSMISSION LINE CAMP COSTS

Item Per Cent of Total Camp Expenditures		Camp Item	Camp Data Double Circuit Steel Tower Line	
Line A	Line B		Line A Two circuits strung	Line B One circuit strung
6	7	Camp Lodging	60,900 bunk nights	15,560 bunk nights
		Caretaker's labor	44%	48%
		Camp supplies	56%	52%
31	26	Camp Meals	62,630 meal days	15,890 meal days
		Mess labor	23%	29%
		Mess supplies	77%	71%
		Meat and eggs	28%	30%
		Canned goods	45%	45%
		Bulk goods	27%	25%
8	8	Moving Camp	28 moves	12 moves
		Payroll labor	58%	52%
		Other expenses	42%	48%
45	41	Total camp operation		
55	59	Labor rolls		
100	100	Total camp expenditures		

Accounting Analyses

Camp foremen were not given the line summary or camp-rating reports. The field bogy sheet furnished them unit costs to shoot at and was not issued until construction had been under way several weeks, during which time a fair bogy cost per cubic yard of holes dug or ton of tower steel erected, etc., could be determined. Bogies might thus not agree with the preliminary line estimate, but this was not as important as convincing the foreman he was not being asked to meet an arbitrary figure.

The labor cost of building transmission lines included cost of operating and moving camps. Table III shows this camp expense to run from 41 to 45 per cent of the total camp expenditures. On the construction discussed, net labor rates were paid and board was furnished free to the men. The cost of feeding, bunking and moving the men was first charged to construction expense accounts in accordance with the standard classification of the national associations. The mess operating account was credited twice a month according to the number of meals served and the proper labor accounts received a prorated charge according to the work the men were doing while such meals were served. No credits were made for the bunk-operating or camp-moving costs, which remained dead charges against the job until a final proration was made to an expense subdivision under the various job accounts. Since the mess cost formed more than half the camp operating cost, it was watched closely to see that meals were furnished at a price close to the mess credit figure adopted. The relations among the various kinds of food supplies and expenditures for mess labor in forming the total meal cost, as shown in Table III, were found useful for check-

TABLE IV—DISTRIBUTION OF CONSTRUCTION EXPENDITURES

Construction Expenditure Group	Group Percentage of Total Construction Expenditures	
	Line A	Line B
Cost control from camp report:		
Man labor roll, structure accounts	27	28
Meal proration, structure accounts	14	12
Team roll, structure accounts	9	6
Cost control from cost rating:		
Lodging and moving camps	10	9
Cost control from line summary:		
Contract haul and office charges	6	7
Motor vehicle operation	3	3
Incidental expense	4	4
Plant and tools, motor vehicle repair and depreciation	12	14
Supervision, insurance and recruiting labor	12	13
Engineering inspection and office	3	4
Total construction expenditures	100	100

ing a camp's loss on mess operation caused by feeding too great a proportion of expensive goods. The cost of moving camp was likewise large enough to warrant analysis; the expense of this operation was found to vary directly with the amount of working time lost by the men while moving.

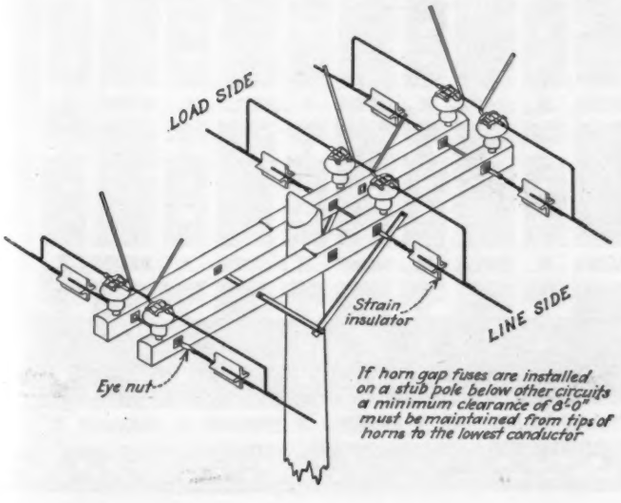
Table IV lists all the expenditures subject to the control of the general superintendent when the work was organized as described. The relative importance of the various groups is apparent.

Prompt Reports Essential

Cost reports on engineering construction should be selective, timely and readable. Cost analysis on transmission line construction is complicated at best by the scattered nature of the work and the diverse construction operations represented. In order that the superintendent may be furnished analyses quickly enough to follow each camp's performance it is necessary that emphasis be placed on selected labor and camp costs without attempting a report on all expenditures, including incidentals such as motor vehicle operation, equipment cost and the like. The time lag in the procedure described is small; daily camp reports are available at the field office in two days, and the semi-monthly summary and camp cost rating are furnished as soon as the cashier's payrolls close. The third requirement, that cost reports be in readable form, applies particularly to the daily labor camp report, which must be followed closely by the foreman for him to get results. A foreman will take pride in establishing the lowest labor costs in competition with other camps only when the cost system is not tied up with too much red tape.

Pole-Mounted Horn-Gap Arresters

Standards of West Penn System

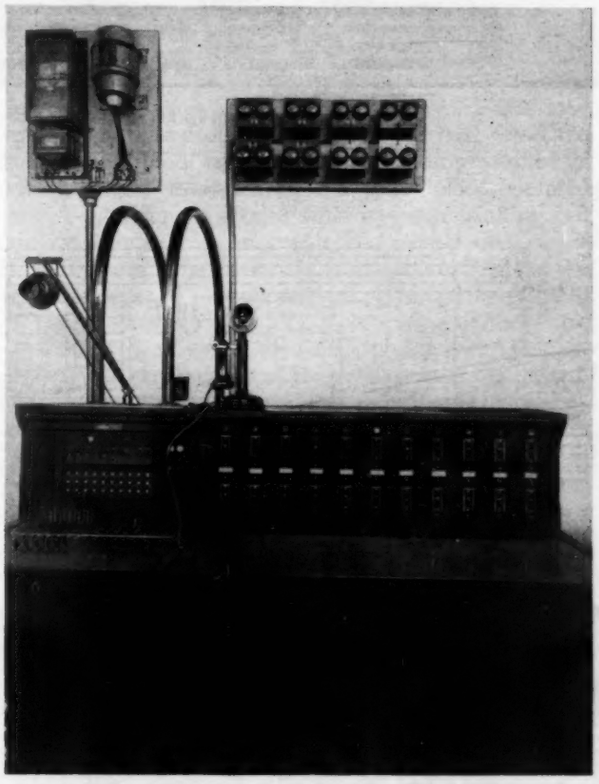

LOAD SIDE
Strain insulator
LINE SIDE
Eye nut
If horn gap fuses are installed on a stub pole below other circuits a minimum clearance of 8'-0" must be maintained from tips of horns to the lowest conductor

Telephone Protective Equipment and Switchboard

By H. B. Cox
Mitchell Dam, Alabama Power Company, Verbena, Ala.

DUE to the fact that practically all telephone lines of the Alabama Power Company are situated either on the 110-kv. rights-of-way or on the 44-kv. line poles, difficulty has been encountered in providing suitable protective equipment and telephone switchboards.

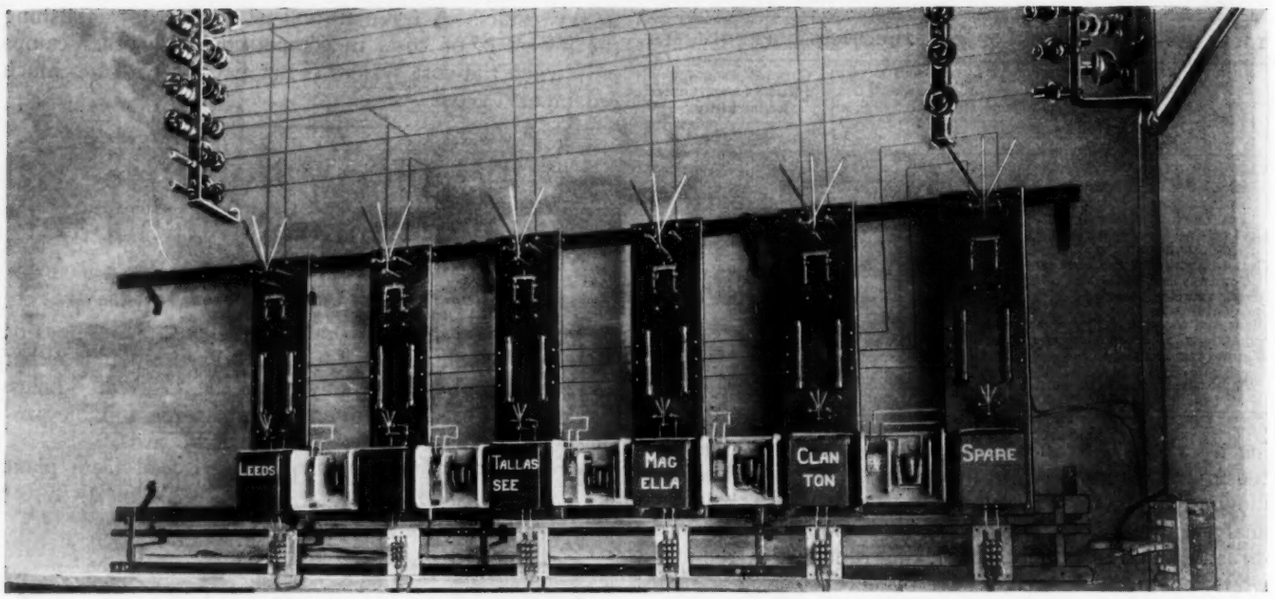
All telephone lines entering the Mitchell Dam plant



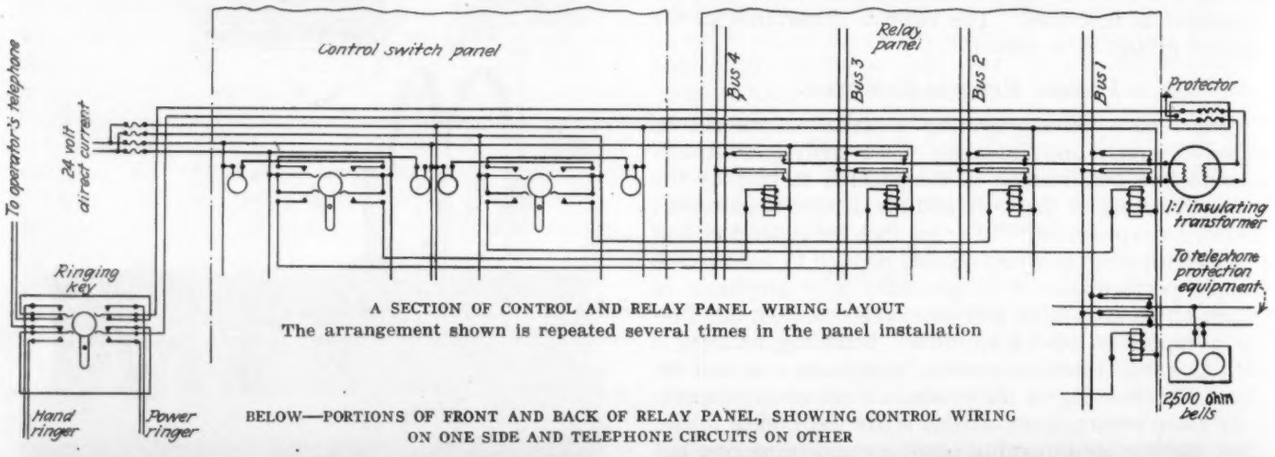
GENERAL VIEW OF TELEPHONE BOARDS WITH BELLS, POLE-CHANGER AND INSULATING TRANSFORMER
Board at left is for camp telephone system

are connected to Osburne Type C protectors mounted on the inside wall of the plant. From here they are carried in iron conduit to the telephone switchboard in the operating room. Although this equipment afforded adequate protection, fuses were continually being blown on the protectors. This meant that the operator or his assistant had to leave the operating room to replace fuses or change over to the spare protector.

The idea was conceived of a relay the coil of which would be connected in series with the ground lead of the drainage coil and so set that any abnormal current would close the relay. After experimenting with a 12-volt, 60-cycle, 15-amp., 660-watt Signal Engineering & Manufacturing Company relay it was found that by rewinding the coil on this relay with approximately 80 turns of No. 16 wire the results desired were obtained. With this

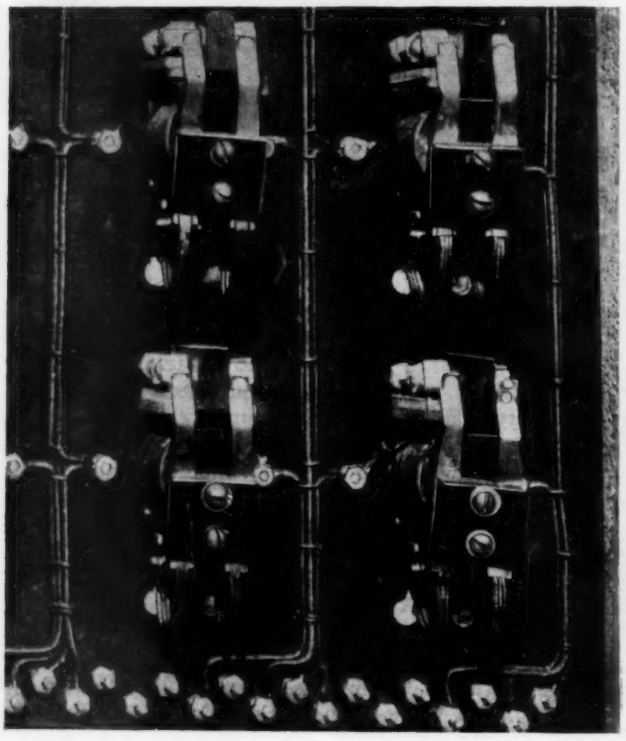


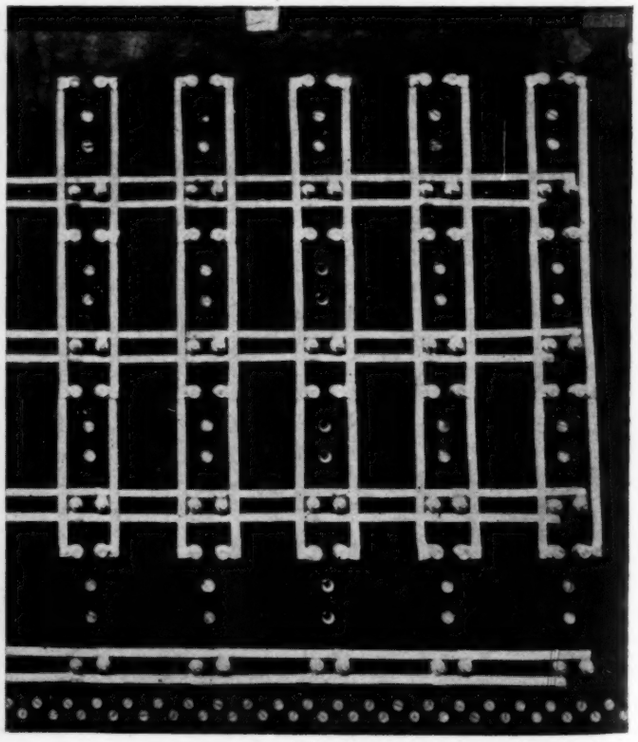
PROTECTORS, GROUNDING RELAYS AND ARRESTERS FOR TELEPHONES ALONG HIGH-VOLTAGE LINES

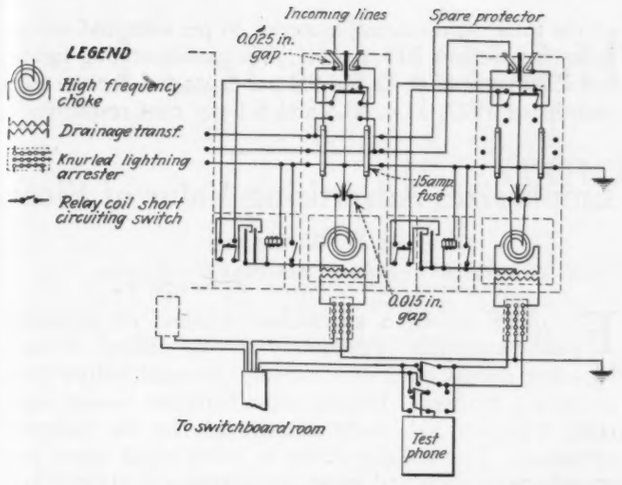


A SECTION OF CONTROL AND RELAY PANEL WIRING LAYOUT
The arrangement shown is repeated several times in the panel installation

BELOW—PORTIONS OF FRONT AND BACK OF RELAY PANEL, SHOWING CONTROL WIRING ON ONE SIDE AND TELEPHONE CIRCUITS ON OTHER

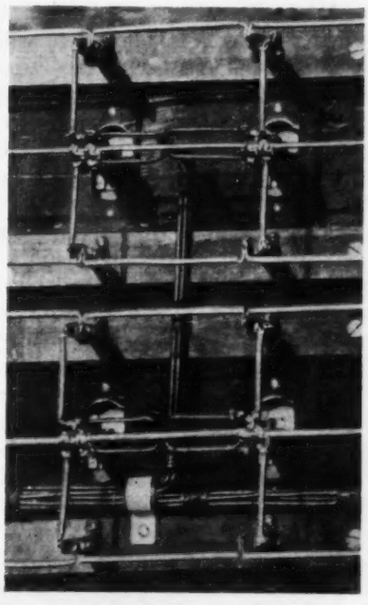






ARRANGEMENT OF PROTECTIVE EQUIPMENT FOR TELEPHONE LINES

coil the relay would close and short circuit both telephone wires to ground in case of abnormal conditions on the telephone circuit and then would open as soon as the trouble cleared. This relay was fast enough to save the fuses. It was found that the manufacturing company had a standard relay with 90 turns of No. 14 wire (0.071 ohm) known as RX-134. This relay has proved satisfactory. Besides the usual large quota of lightning and power line disturbances during the past year there have been two instances of direct contact of telephone lines with high-voltage power lines. During this time but one pair of fuses provided with this equipment has been blown.



PORTION OF REAR OF CONTROL OR KEY PANEL

It was necessary to have eleven circuits and four buses on the telephone board serving the right-of-way telephone lines to enable carrying on four conversations at the same time. Numerous standard switches and plug devices were tried out, but none was found that would withstand the continuous operation necessary and at the same time give maximum protection to the operator. Finally the General Electric Company HG-2 switch relay was remodeled, making it a double-pole relay, and this proved satisfactory.

These relays are grouped and mounted on a panel and are equipped with 24-volt, 0.15-amp. continuous-rated coils operated from a 24-volt storage battery, which also supplies the common-battery board for the camp circuits. This panel is of ½-in. Bakelite and is mounted approximately 12 in. back of the control or key panel. The wiring to the coils is all on the front of the relay panel; the actual voice-circuit wiring is in the rear, facing the back of the cabinet. With this arrangement the battery control wires could be better insulated from the telephone circuits. The stationary contacts of these relays are used for the line side, so that the maximum clearance could be obtained when the circuits were not in use.

The control or key panel is made of ⅜-in. Bakelite. Standard Kellogg double-locking switchboard keys are used for the control. Red, green, white and amber signal lamps are used to designate the four buses.

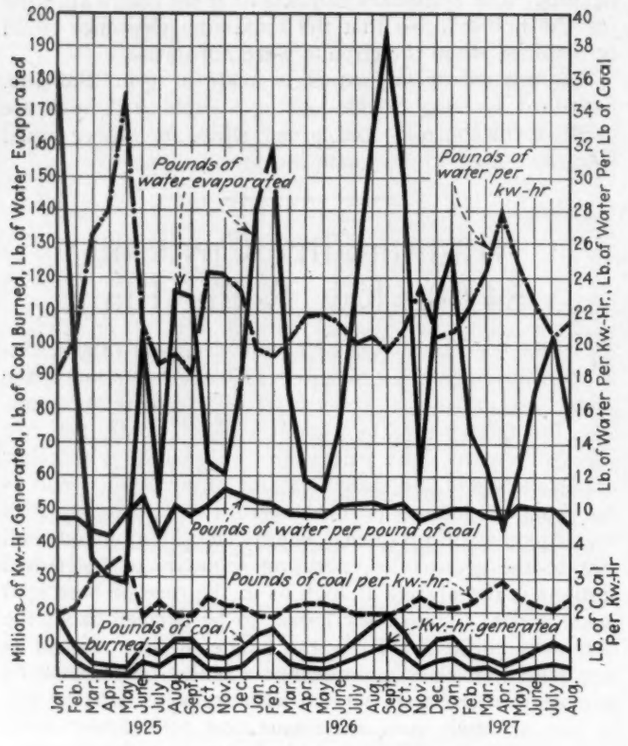
Maintenance Costs of a 54,000-Kw. Boiler Plant

FROM the data sheets of a New England central station in which constant effort is made to maintain the steam boiler plant at "concert pitch" the costs are available for the 32 months ended Aug. 31, 1927, and are given herewith. The plant is interconnected with other important steam and hydro stations in its vicinity, and as the group of stations is run by centralized authority with the objective of producing energy at minimum over-all cost to the group, the operating economy of individual stations is not always as high as in the case of base load installations. The major lesson to be derived from the cost data presented from the single station studied is that with first-class maintenance a boiler plant operated in energy interchange service with frequent banking can be run at fairly uniform repair cost totals even after eight to ten years' service. It is not known when the annual maintenance cost per kilowatt-hour generated will begin to increase materially due to the aging of the plant, but the value of a high-grade repair policy with constant inspection and replacement of material is clearly indicated.

The plant contains twelve 700-hp. Edgemoor water-tube boilers equipped with three drums each and Foster superheaters and seven-retort Taylor stokers. Steam is supplied at 225 lb. operating pressure and 150 deg.

MONTHLY MAINTENANCE COSTS OF BOILER PLANT

	Total Cost of Maintenance	Cost in Mills Per Kilowatt-Hour Generated
1926		
January	$4,368	0.44
February	5,100	1.14
March	4,026	2.88
April	5,803	5.40
May	1,951	2.42
June	1,450	0.30
July	6,353	2.11
August	4,183	0.69
September	4,821	0.76
October	4,832	1.82
November	4,504	1.83
December	3,853	1.04
Year	$51,244	1.10
1926		
January	$5,540	0.78
February	5,625	0.68
March	7,202	1.68
April	7,862	2.90
May	3,067	1.18
June	2,934	0.83
July	2,606	0.44
August	2,488	0.31
September	5,150	0.52
October	4,650	0.66
November	4,750	1.88
December	4,426	0.79
Year	$56,300	0.83
1927		
January	$3,935	0.63
February	5,042	1.52
March	4,904	1.38
April	2,825	1.74
May	2,976	1.18
June	3,488	0.93
July	2,439	0.49
August	3,916	1.10
Period	$29,525	1.09


Millions of Kw.-Hr. Generated, Lb. of Coal Burned, Lb. of Water Evaporated
Lb. of Water Per Kw.-Hr., Lb. of Water Per Lb. of Coal
Lb. of Coal Per Kw.-Hr
Pounds of water evaporated
Pounds of water per kw.-hr
Pounds of water per pound of coal
Pounds of coal per kw.-hr.
Pounds of coal burned
Kw.-hr. generated
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug.
1925
1926
1927

OVER-ALL PERFORMANCE OF BOILER PLANT

superheat to four turbo-generators rated at 4,000, 5,000, 20,000 and 25,000 kw. Forced draft is provided by one motor-driven and four steam-driven fans, and there are four steel stacks, tile lined, carried on the building frame to a height of 196 ft. above the boiler room floor, the inside diameter of each stack being 13 ft. Bituminous coal of about 14,450 B.t.u. is burned.

Monthly records are kept by the company of the expenditures upon each boiler and upon the boiler plant as a unit. From these it appears that in 1925 the over-all cost of boiler plant maintenance was 1.1 mills per kilowatt-hour generated; in 1926 it was 8.3 mills, and for the eight months covered in 1927 it was 1 mill. Space will not permit tabulating the itemized maintenance costs of the individual boilers from month to month, but the accompanying chart shows the monthly variations in energy output for the period, the amount of fuel burned, water evaporated, and unit fuel and water data for the group of twelve boilers.

The output of the plant depends to a considerable degree upon the amount of water available at the principal interconnected hydro-electric station of the regional group, and during the low-water periods the increased load upon the steam station results in much better monthly economy in coal burned per kilowatt-hour generated. No connection appears between the boiler plant output in any given month and the total maintenance outlays. As the policy of the company is to keep plant repairs up to top notch all the time, this is not surprising, and wear and tear upon this class of equipment appear to be cumulative rather than imposed primarily by peak load conditions.

The accompanying table shows the total monthly maintenance costs of this group of boilers in dollars and mills per kilowatt-hour generated by steam for the period covered.

Analysis of the detailed items making up these costs shows that in 1925 labor costs represented 44 per cent of the total maintenance, material 36 per cent and miscellaneous vouchers 10 per cent. The corresponding figures for 1926 were 45.6, 45 and 9.4 per cent; and for the eight months of 1927, 51.4, 43.5 and 5.1 per cent respectively.

Emphasizes Advertising Value of Floats

By H. W. Ewald

Assistant to Manager Suburban Retail Sales, Duquesne Light Company, Pittsburgh, Pa.

FLOATS afford a spectacular method of attracting public attention. Frequently persons difficult to reach by other means observe a message brought before them in such a manner. During the Christmas season especially it pays to bid loudly and strongly for the shoppers' attention. The holiday dollar is being spent more generously than ever, and elaborate advertising appeals help direct the would-be purchaser.

With this purpose in mind the Electric League of Pittsburgh, in collaboration with the Duquesne Light Company, planned its 1926 Christmas float. When, during those busy days before Christmas, the question "What shall I give?" was foremost in everyone's thoughts, the Electric League float paraded the streets and flashed the answer, "Give Something Electrical!"

The float, which might well be described as a traveling billboard de luxe, traveled over hundreds of miles of local territory and was seen by more than a million persons. With the services of two drivers, it was on the streets sixteen hours daily for several weeks. Fingers pointed at it, heads turned to look after it and teachers directed the attention of groups of school children toward it as it passed slowly through the streets of Pittsburgh and the surrounding territory.

The bright lights that chased one another all around the frame of the signs and glowed in lovely colors and the artistically painted figures of cut-out sheet iron en-

THIS TRUCK FLOAT TRAVELED SEVERAL HUNDRED MILES AND VISITED MANY COMMUNITIES NEAR PITTSBURGH TO CARRY THE HOLIDAY SALES MESSAGE, "GIVE SOMETHING ELECTRICAL"

hanced the general attractiveness of the transformed truck. The spectacular lighting effects employed were made possible by equipping the truck with a farm-lighting unit of approximately 2,000 watts.

Seasonal and holiday occasions for operating floats should be regarded as real advertising opportunities, if one is to judge from the altogether satisfactory results achieved from this experiment.

Tests Indicate No Hazard

in Armored Cable

Maximum temperatures reached with conductor-to-armor ground, with short circuit between conductors, with armor carrying short-circuit current. Effect of nail driven through cable

By E. H. Lewis

Armored Conductor and Metallic Flexible Conduit Section, National Electrical Manufacturers Association

IN THE past few years there have been various developments that conflict with or supersede former ideas. One such development in the field of wiring materials and methods has been the introduction of non-metallic sheathed cable, which closely approximates armored cable as far as usability is concerned. As would naturally be expected where divided interests are concerned, both sides have made statements that might tend to alter the opinions of consumers regarding the safety of the two materials. To obtain complete data about armored cable, the tests described here were conducted at the Bridgeport works of the General Electric Company under the auspices of the armored cable section of the National Electrical Manufacturers Association.

The tests were made with standard No. 14 B. & S. gage, two-conductor, single-strip armored cable, taken from stocks of materials received from sixteen manufacturers. The specimens are designated by numbers, so that no distinction is shown between products.

When Armor Carries Load Current

The first test was to determine the maximum temperature reached when an accidental ground causes the armor to act as a conductor. A small section of a wall was constructed of studs, lath, sheathing, etc., so as to approximate actual conditions. Four 6-ft. lengths of cable were fished through holes in the studs about 8 in. apart. The cables were connected in series, the armor and one of the wires acting as the two conductors. Thermometers inserted through holes in the wall section were fastened to the surface of the armor with putty, separate thermometers being used for each length of cable. Under a load of 15 amp., the maximum allowed by the code for No. 14 B. & S. wire, temperature readings were taken every hour for 24 hours. The readings are shown in Table I.

In each case the armor reached a maximum temperature in about five hours and remained practically constant for the remainder of the 24-hour run. After about five hours the heat was being dissipated, because of air currents, as fast as it was generated. The temperature of nine of the lengths remained less than 60 deg. C., the maximum allowed for the heating of conduits, and the six other samples varied from 62 to 82 deg. C. In no case did the samples reach a temperature that might have been hazardous; the highest temperature was 18 deg. C. below the boiling point of water. Taking it for granted that the cross-sectional areas of the lengths were uniform, as covered by Underwriters' Laboratories specifications, it was concluded that the fluctuations in temperature varied with the change in armor resistance resulting from variations in the "grip" between convolutions of the armor. The two theoretical limits would be maximum resistance when the steel strip is stretched out, and minimum resistance when there is a solid steel tube of the same physical dimensions as the conduit itself. This was further brought out in the next experiment.

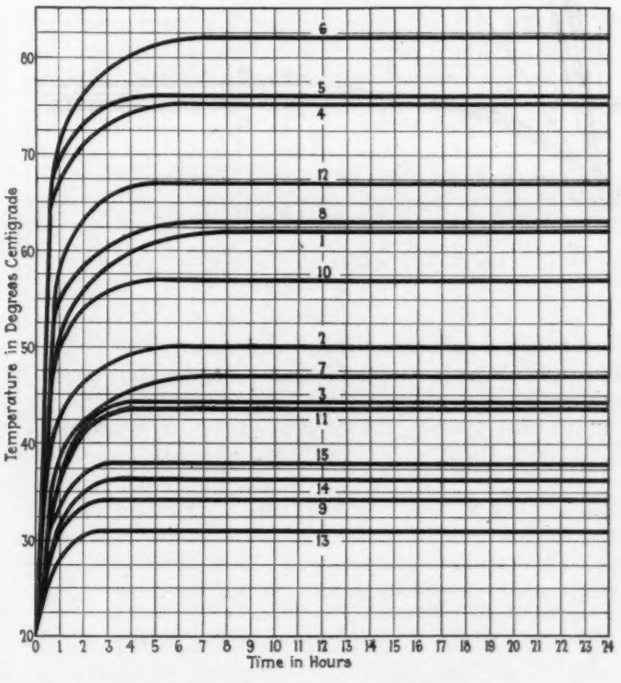


FIG. 1—RESULTS OF HEAT RUN ON FIFTEEN ARMORED CABLES

When Armor Short Circuits Line

The second test was conducted to determine the performance of armored cable when the armor caused a "dead short" circuit across the line. Five lengths of different makes of cable, each 25 ft. long, were installed in a line, with outlet boxes at the junctions, a pilot light at the end, necessary ammeters, fuse cutouts, etc. The black conductor was electrically connected to the armor at one end of the line and the white conductor at the

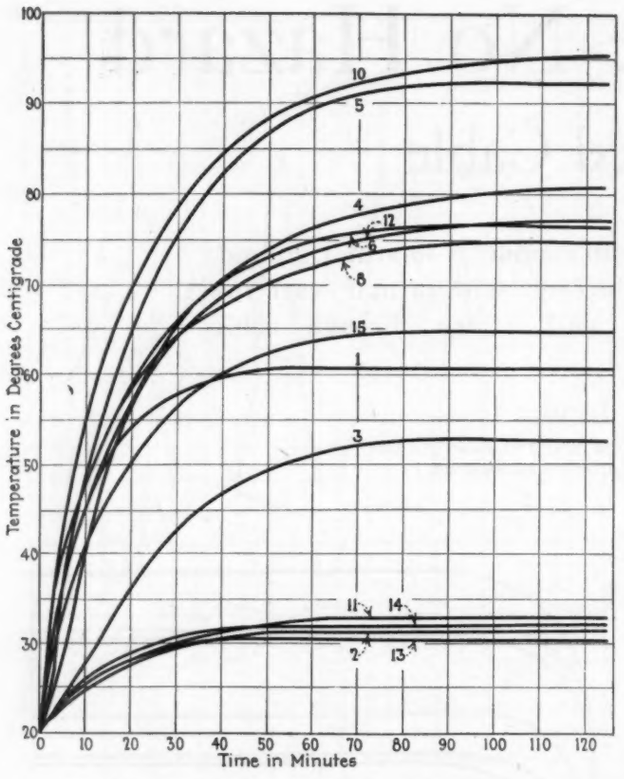


FIG. 2—RESULTS OF SHORT-CIRCUIT TEST ON FIFTEEN ARMORED CABLES

other end. When the circuit was closed, the 15-amp. fuses were blown in about seven seconds. To parallel field conditions, pennies were inserted in the 15-amp. cutouts, thus leaving the 30-amp. fuses to protect the entire line. When this circuit was completed, the lamp remained lighted and the temperature of the armor increased. The ammeter at first read 25 amp., and after about ten minutes dropped to 20 amp. because the resistance of the armor increases with the temperature. The 20-amp. load remained constant during the remainder of the test.

In the third test 25-ft. lengths of each make of cable were laid on a bench and four thermometers attached at intervals of 5 ft. along each length. A load of 25 amp. was then passed through a conductor and its armor for ten minutes, and the load then reduced to 21 amp. to parallel the conditions found in the previous test. The results are shown in Table II. The graphs (Fig. 2) closely check with those of the 15-amp. heat-run test, the slight variations in results probably being due to differences in samples. This short-circuit test approximated the extreme conditions in the field when a length of armor is forced to carry the full load because of a short circuit. The temperature in this case varied from 30 to 95 deg. C., less than the temperature of boiling water.

To check the findings that the temperature of the cable depends on the "fit between convolutions of the armor, short lengths of one of the cables that had been heated were temporarily stretched, with the result that the stretched portion cooled slightly, whereas the rest of the cable remained warm. Similar results were obtained when the convolutions were pushed together or when the cable was bent with a short radius. For the other extreme, a short portion of the cable was stretched so as to separate the convolutions. In this case, as was expected, that portion became warmer than the rest of the cable. These tests confirmed the theory that the rise of temperature of the armor is inversely proportional to the tightness of the convolutions of the armor, the load remaining constant.

The question has often arisen as to the damaging effect of a nail driven through a piece of installed armored cable. To approximate such a condition, nails were driven at random angles into a length of armored cable. In each case the fuses were immediately blown, showing that short circuits resulted. To parallel the case when the nail would only graze the conductor and possibly cause it to arc, a stress of 20,000 volts between the armor and one conductor was employed so as to break down and carbonize a spot in the wire. If any arcing were to occur, it would take place at this prepared spot. This preparation was necessary, since it would be nearly impossible to pick up any piece of cable at random and expect to produce arcing similar to that experienced in actual field conditions. A 110-volt line, protected first by 15-amp. and then by 30-amp. fuses, was connected

TABLE I—DATA ON HEAT RUN WITH ARMORED CABLE IN WALL

No. 14 B. & S., two-conductor, single-strip armored cable. Voltage, 110. Current, 15 amp. One conductor and armor carrying current. Temperature in degrees centigrade.

Time in Hours	Sample Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
½	45	30	28	61	63	49	29	40	27	35	26	38	24	24	27
1	52	43	36	68	70	75	40	58	33	49	36	59	28	31	35
2	57	47	43	73	74	79	44	62	34	53	43	62	31	35	38
3	58	48	43	74	75	78	44	61	34	56	44	67	31	36	39
4	58	49	44	73	74	78	44	60	33	57	44	67	31	36	38
5	59	49	44	72	74	79	45	61	33	57	44	67	31	36	39
6	61	50	44	77	79	80	45	62	34	57	44	67	31	36	39
7	62	50	44	78	78	82	47	63	34	57	44	67	31	36	38
8	62	50	44	79	79	82	47	63	34	57	44	67	31	36	38
9	61	50	44	77	78	82	47	63	34	57	44	67	31	36	38
10	61	50	44	76	77	82	47	63	34	57	44	67	31	36	38
11	60	48	44	73	75	82	47	63	34	57	44	67	31	36	38
12	59	47	44	72	75	82	47	63	34	57	44	67	31	36	38
13	60	48	44	74	76	82	47	63	34	57	44	67	31	36	38
14	59	49	44	75	75	82	47	63	34	57	44	67	31	36	38
15	63	49	44	76	76	82	47	63	34	57	44	67	31	36	38
16	63	49	44	76	76	82	47	63	34	57	44	67	31	36	38
17	63	49	44	74	75	82	47	63	34	57	44	67	31	36	38
18	62	48	44	73	74	82	47	63	34	57	44	67	31	36	38
19	62	48	44	74	74	82	47	63	34	57	44	67	31	36	38
20	62	48	44	74	75	82	47	63	34	57	44	67	31	36	38
21	60	45	44	71	71	82	47	63	34	57	44	67	31	36	38
22	64	46	44	74	76	82	47	63	34	57	44	67	31	36	38
23	65	48	44	74	76	82	47	63	34	57	44	67	31	36	38
24	65	47	44	74	76	82	47	63	34	57	44	67	31	36	38

TABLE II—DATA FROM HEAT RUN ON BENCH

Voltage, 110. Current, 25 amp. for first ten minutes, then 21 amp. for remainder of test. One conductor and armor carrying current. No. 14 B. & S., two-conductor, single-strip armored cable. Temperature in degrees centigrade

Time in Minutes	Sample Number 1	2	3	4	5	6	8	10	11	12	13	14	15
0	20	20	20	20	20	20	20	20	20	20	20	20	20
5	34.5	22.75	22	31.5	32.25	40.75	39.5	33.25	23.25	34.75	24	22.5	29.25
10	46	25.25	27.5	44	34.75	47.25	47.25	48.75	26	43.5	25	25.5	39
15	52.25	26.75	30.5	48.25	58	54.5	51.25	62.26	27.5	50.25	26.5	27.75	47.25
20	54	27.75	36.25	57.5	66	59.75	57	69	29	54.75	28.25	28.25	50.5
25	55.5	28.5	40	62.25	70.5	62.75	61.75	74.5	29.75	60.5	28.75	28.5	54
30	57	29.5	40.25	66.25	76	65	64	79	30.5	64.25	29.25	30.5	56
45	59.5	30.5	47.5	72.75	84	70.5	69.25	84.75	32	69	30.25	31.25	61.25
60	61	31.25	51	76.75	90.25	74.75	72	88.5	32.75	73.5	30.25	31.75	64
90	61	31.75	53	80.25	92.5	76.5	74.75	94	33.25	76	30.75	32.25	64.75
120	61.25	31.75	53.25	81	93	76.25	75.5	95.5	33.5	77	30.75	32.25	67.75

between the armor and the fractured wire. When the load was applied, the fuses were blown every time. When the line was protected by a 100-amp. fuse, there were one or two flashes and then the action ceased. Upon dissecting the cable it was found that the flashes had completely fused the copper wire and that the circuit had been broken.

By means of these experiments, an attempt was made to parallel the various conditions to which armored cable is subjected in the field, and in no case was the cable found to present hazards.

Electrically Heated Forging Furnace

By H. George D. Nutting
Sales Engineer Detroit Edison Company, Detroit, Mich.

AN ELECTRIC metal heater has been installed in a Detroit automobile parts plant to heat steel for upsetting purposes. This heater, known as the Berwick metal heater and made by the American Car & Foundry Company, is similar to an electric rivet heater, but handles much larger work. The current is passed directly through the piece to be heated. The maximum-sized piece heated is 1½ in. in diameter and the heated portion is 6 in. long. The piece is clamped between two pairs of contacts and a current of about 15,000 amp. is passed through the metal at 1 volt to 1½ volts.

There are five sets of contacts; therefore five pieces can be heated simultaneously. The heater, when running full shows a maximum demand of 72 kw. This is not the average demand.

In operating this heater it has been found desirable to pickle the stock to be heated, inasmuch as scale causes trouble at the contacts. When this equipment was first placed in operation, some pieces were lost by overheating, due to leaving them clamped in the contacts too long. These pieces broke off about 2 in. from the end when they were thrown down on to the floor. Tests showed a desirable forging temperature of 2,100 deg. F. and a burning up temperature of 2,450 deg. F. These tests were made with a radiation pyrometer. This chance of burning stock indicated that automatic control would be desirable.

After some study it was concluded that it would be very difficult and expensive to apply automatic thermal control, chiefly because of the difficulty of applying a thermocouple to the metal being heated and also because each set of contacts would need to have an automatic pyrometer. Further, a control that did not actually throw the pieces out of the contacts would not be of much value. Visible or auditory signals would only sound warnings without actually preventing burning by breaking the circuit, hence these would not be satisfactory.

A control based on the time a given piece was clamped between the contacts to give the proper forging heat is suggested but has not yet been tried. Timing tests on pieces being heated showed that this method might work out.

This heater has been in operation for nearly a year and has been adopted after three gas furnaces of different designs were tried on this work without success.

The contacts are simple tangential ones, no attempt being made to make them the same shape as the heated piece. The contacts were made of heavy copper, not water cooled. They are adjustable for heat length of about 2 to 7 in. One man operates the heater, another the upsetting machine. A second heater of the same size is now being installed, and one man will operate the two heaters. The operators are willing to make an extra effort to operate these electric heaters because of the comparative coolness and absence of hot fumes.

Another advantage is that the heater does not have to be started in the morning two or three hours before time to start work. Also, it is shut off dead when work is stopped at the end of the day. Figuring only fuel against electricity, it is not as cheap to operate as a gas- or oil-fired furnace, but considering the quality of the work and other conditions, it is more economical than fuel-fired furnaces.

There will be some maintenance costs, but they will not

FRONT AND REAR VIEWS OF BERWICK METAL HEATER USED TO HEAT STEEL FOR UPSETTING PURPOSES

be high. The contacts wear surprisingly well. It has been found necessary to file or scrape a thin scale off of the contacts two or three times a day, but this is no particular trouble and requires very little time.

The equipment heats about 4 lb. of metal per kilowatt-hour. This means actual metal heated between contacts. Each piece takes about 2½ min. to heat, compared with 30 min. per piece in a gas furnace. Of course a fuel-fired furnace would take many more pieces per foot of length of the furnace. The pieces are removed after heating, by the judgment of the operator. They scale up some, but they do not grow. The cold end (about 6 in. long) remains cool enough so that the piece can be removed with a gloved hand. This condition also gives good backing in the upsetting dies, preventing metal flow at the end where metal flow is not wanted.

Faster heating can be accomplished, but it results in burning at the contacts. This heater has been given a thorough trial, and experience thus far shows it to be a successful electrically heated forge furnace.

Handling High-Bill Complaints

By Henry C. Land
Virginia Electric & Power Company

IN THE handling of high-bill complaints, the ideal for which we strive is perfect satisfaction on the part of our customers. We want more than an appeased customer; we want one who is pleased with both our service and our treatment. Before we can hope to gain this approval or even deserve it, we must render a satisfactory service in a satisfactory way. This requires the co-operation of every employee.

The customers' service bureau, a division of the sales department, handles high-bill complaints, contracts, line extensions, service calls and anything pertaining to customers' service.

A high-bill complaint may originate in any department. Whenever we hear a customer complain about the size of his bill, that is the opportune time to explain the ideal of the company. We endeavor to show the customer that his complaint is not justified. If it is not possible to satisfy him, he is told that the matter will be investigated. He is not allowed to nurse his grievance. An immediate report of the complaint allows us to give attention to the trouble much more quickly than might be the case if there is a delay. Forms provided for this purpose are kept at hand. By handling a complaint out of working hours, we show the customer that we are interested in his welfare. He will more readily believe that it is our wish to give him the best possible service.

In talking to a customer about high bills, we try to place ourselves in his position. Of course, a large proportion of the complaints are unjustified, but nearly all the customers who complain about their bills believe that there is something wrong. Would they make a trip downtown or go out of the way to complain about something that they know to be right? In a number of cases they come to us to find out what the trouble is. They may know the bill is all right, the meter accurate and that the company is fair and honest, but they cannot see where they can possibly use that much current.

The small bill is the one to be the most careful about. All of us listen with interest when the large consumer complains. We forget that the small increase in his bill is just as important to the small consumer as the large one is to the large consumer. It is hard to lay down any firm and fast rule for dealing with a customer. We can treat him with respect, courtesy, interest, tact and diplomacy. We can listen to his grievance. We may show him, if it is winter, that the nights are longer and the days dark and that he is probably using two or three times as much current as he did in the summer. In some cases when we start to reason he becomes irritable and we must be more tactful and courteous than ever. We may talk to him for a while and find some entirely foreign subject in which he is interested and so get on friendly terms.

In a number of cases the customer will make the statement that he knows nothing of electricity. That is an opportunity for us to tell him some of the fundamentals and show him how to read a meter. It is not difficult to point out that meter readers, like the rest of us, are likely to make mistakes. We can point out that even if a mistake is made in the reading, it will automatically correct itself. Of the four figures read, a mistake that materially affects the bill can be made in only one of them without the mistake being apparent to the checker. Whenever an error in reading seems apparent, the meter is reread without any request from the customer. Wholesale power bills are checked by a representative of the sales department. This is done to catch any mistake in billing.

We do not ask a customer point-blank what appliances he uses. If this is done, we may suggest to him that he is using too many of them or that we want these figures to estimate his bill. This point may seem ridiculous, but it is valid, for the education of the public has not been completed. If we listen to the customer, he will often tell just what appliances he uses and the length of time he uses them. His consumption may then be figured. If he does not tell us, we can approach the subject in a tactful manner by inquiring the way in which he uses electric service.

Complaint Handled Locally

Perhaps a number of investigations of complaints could be avoided by having the customer go to the accounting department, but nothing exasperates an angry person more than to send him to several offices. At the present time we have anyone take the complaint. If possible, the customer is requested to talk to someone in the service bureau. The customer's account is investigated to determine the amount of his bill for the corresponding period in the previous year to see that no apparent mistake has been made. The complaint is followed up by a personal call. The reading and accuracy of the meter are checked. A test is made for a ground. The customer is interviewed. He is encouraged to talk and ask questions and everything possible is explained to him, such as the difference between a carbon and a Mazda lamp, and that the cost of operating a lamp depends upon the wattage. The function and accuracy of the meter are explained and the customer is shown how to read the meter. If he is not satisfied with this test, an official test is made by the meter department. In some cases it is necessary to install a graphic wattmeter to show the customer when and how the energy is being used.

We avoid the impression that we are always right. Sometimes we make a mistake that might be classified as impossible.

Fractional-Hp. Motors Rated

Joint committee meeting of utilities, motor and appliance manufacturing companies agrees on ratings and performance specifications. New designs to be developed

THE utility companies, the motor manufacturers and the appliance manufacturers have been trying for several years to reach agreement about fractional-horsepower-motor performance specifications. During the past year the joint committee on fractional-horsepower motors representing these groups has been very actively at work. In Detroit on March 3 of this year this committee reached agreement on performance specifications for the ¼-hp. motor used on refrigerators and oil burners. These specifications and an outline of the general problem were published in the ELECTRICAL WORLD of March 12, page 583.

On Nov. 17 the joint committee met in Cleveland to act upon suggestions that it consider all sizes and types of fractional-horsepower motors and make an attempt to agree upon performance specifications. This meeting brought out evidence that two lines of fractional-horsepower motors were desirable to meet present service and economic conditions. The committee agreed that there should be a line of motors for long-hour-service applications where efficiency was readily capitalized. It also agreed that another line of motors was needed for applications used very few hours each year where efficiency could not be capitalized. At this meeting the suggestion was made that these two classes of motors could be designed for about the same power factor, and that economic values in service applications could be counted upon to cause the selection of proper motors for particular applications. It was also suggested that definite ratings be had for these two classes of motors, these ratings to specify minimum values for power factor, efficiency, apparent efficiency and locked rotor current.

At a meeting in Cleveland on Dec. 1 data were presented by the motor manufacturers covering these items and much constructive work was done to clarify the whole fractional-horsepower-motor situation.

As shown in the accompanying table, the motor manufacturers presented figures for power factor, apparent efficiency and real efficiency which represent minimum values much better than are now available. As pointed out by the motor manufacturers and as shown in the tables, the proposed lines of motors will compel a complete redesign, much retooling and increased costs for many motor manufacturers. It was estimated that the cost of getting these motors on the market would be upward of $1,000,000. After a full discussion of the figures presented and assurance to the motor manufacturers that these motors would be used by industry if made, the joint committee passed the following motion:

Resolved, that the joint committee on fractional-horsepower motors accept the proposed ratings for power factor, efficiency and apparent efficiency, these ratings to be applied to all fractional-horsepower motors and to be used on motors as soon as possible, the final date for all motors being Jan. 1, 1929, except for the ¼-hp. long-hour motor, which, according to the Detroit agreement, was to be available Jan. 1, 1928.

The motor manufacturers said that the time allowed for developing the new motors was not any too long for many manufacturers who would be compelled to redesign their entire line and revamp all factory tools and operations. The utilities took the position that during the interim poor motors were not to be dumped on the market.

After agreeing upon these data, the committee next discussed locked-rotor current values. The motor manufacturers presented the accompanying table of values to apply to all 115-volt fractional-horsepower motors except those now used on washing machines, ironing machines and some dishwashers.

MINIMUM EFFICIENCIES AND POWER FACTORS FOR 115-VOLT FRACTIONAL-HORSEPOWER MOTORS

Size of Motor	Power Factor	Efficiency	Apparent Efficiency	
			Long-Hour	Short-Hour
⅛	52	53	30	24
⅙	56	58	36	27
¼	60	62	42	32
⅓	61	63	44	35
½	63	65	47	39
¾	65	67	49	42

VALUES FOR 115-VOLT FRACTIONAL-HORSEPOWER MOTORS

Size of Motor	Locked-Rotor Current	Three-quarters Locked-Rotor Current
⅛ hp. and less.....	20	15
½ hp.....	26.6	20
¾ hp.....	40	30

An active discussion ensued in regard to making any exceptions to the general specifications on current values. The utility representatives took the position that the large starting current of washing-machine motors, for example, was causing service complaints because of voltage dips and resulted in large expenditures by the utility to improve regulation. They said they saw no reason for discriminating between appliances and stated that any rule with exceptions was extremely difficult to enforce.

The washing-machine manufacturers took the position that the present washing-machine motor had been developed through years of experience and was now perfectly satisfactory to do the work required with a minimum of servicing. The present washing machine incorporates the motor dimensions as part of a harmonious design, and the use of a motor of different dimensions and of a different type would involve large costs in redesign and increased service expense. They said that an increase in the list price of washing machines of from 20 to 30 dollars would react disastrously on merchandising and that the change in motor type was not warranted

COMPARISON OF PRESENT POWER FACTORS WITH NEW MINIMUM POWER FACTORS

Horsepower of motor	⅛	¼	⅓	½	¾
New minimum.....	52	56	60	61	63	65
Present practice of leading companies	42	50	54	57	62	63
	55	57	66	66	66	72
	52	52	58	63	57	69
	50	53	56	58	60	60
	52	53	54	58	60	54
	.....	50	54	48	54	54
	.....	60	63	64	65	65
	.....	60	56	58	63	67
Number of companies under minimum...	1	5	6	5	5	4

COMPARISON OF PRESENT EFFICIENCIES WITH NEW MINIMUM EFFICIENCIES

Horsepower of motor	⅛	¼	⅓	½	¾
New minimum.....	53	58	62	63	65	67
Present practice of leading companies	57	55	61	63	65	69
	56	64	64	67	70	70
	50	52	58	63	67	71
	50	55	58	61	65	69
	44	55	60	64	63	67
	.....	50	58	63	63	65
	.....	50	60	63	65	65
	.....	48	51	59	64	67
Number of companies under minimum...	3	7	7	2	3	6

because the vast majority of washing machines did not operate when lights were burning. Active discussion brought no agreement, but a final development was to approve the specifications proposed and reserve the exceptions for action in the immediate future. This action was to have the utility representatives and appliance manufacturers concerned meet together for discussion in a representative group to develop a plan which would be acceptable to the joint committee as a whole.

With this understanding the following motion was passed by the joint committee:

Resolved, that the joint committee on fractional-horsepower motors approve the values for locked-rotor current and three-quarters-locked-rotor current proposed by the motor manufacturers. These values to apply to all motors except those split-phase motors which exceed the proposed values; these exceptions to be considered in the immediate future.

The completion of this work marks a big step forward in the small-motor situation and follows along lines which are developing whereby all sizes of polyphase motors are to be rated in similar values.

Those represented on the joint committee are the National Electric Light Association, National Electrical Manufacturers Association, Association of Edison Illuminating Companies, American Washing-Machine Association, Ironing Machine Association, American Association of Oil Burners, the refrigerator manufacturers and several appliance manufacturers who were not members of organized groups. L. W. W. Morrow, managing editor of the ELECTRICAL WORLD, is chairman of the joint committee.

Official acceptance of the action of the joint committee will be asked of the representative groups whose delegates form the committee. A meeting of appliance manufacturers and utilities has been called in Chicago on Jan. 6 to discuss starting current and locked-rotor current values for those motors about which agreement was not had at the meeting in Cleveland.

Utility Advertises Customers in Advertising Service

TO SHOW the wide application of electricity and the extent to which commercial and industrial enterprises are dependent upon reliable electric light and power for their success, the Los Angeles Gas & Electric Corporation is running a series of newspaper ads of a type that is relatively new to electric utility advertising. Newspaper space to the extent of three columns, 15 in. long, is used for each ad and one particular customer receives indirect advertising in each ad of the series.

Electric Refrigerators Displayed in Street Cars

By W. G. THOMPSON
Foreman Range and Refrigerator Department, El Paso Electric Company

CAR RIDERS in El Paso, Tex., have had the attractions of electric refrigeration effectively brought to their attention this fall by an operating exhibit of a cabinet type unit on a Birney car used in regular service by the transportation division of the El Paso Electric Company, a Stone & Webster property. The refrigerator is installed at the front end of the car just behind the operator, where all boarding passengers are bound to be attracted by the unusual display. The installation was made by replacing the standard alternating-current motor with a 110-volt direct-current motor, a resistance of 220 ohms being connected in series to enable the unit to be operated from the 550-volt trolley circuit. All compartments of the refrigerator are filled daily with fresh foods arranged appetizingly on the visible shelves, and the value of electric refrigeration in winter is featured in a display card at the top of the cabinet. The car carries about 36,000 passengers per month, and many live "prospects" have been obtained through the exhibit.

ELECTRIC REFRIGERATOR INSTALLED IN TROLLEY CAR ACTS AS SILENT SALESMAN

TYPE OF HOME IN WHICH CALIFORNIA WATER-HEATING TESTS WERE MADE

Water-Heater Diversity

Preliminary California survey shows diversity of 2 1/3. This factor is not affected by double-throw switch. Test data and graphs show major operations

UNDER the direction of the water heating committee of the N.E.L.A. preliminary tests were made on groups of water heaters in two California towns during April and May last to obtain information necessary to lay out a definite working plan for making a comprehensive water-heating survey and to determine the cost thereof. One test was made in the town of San Joaquin on the system of the San Joaquin Light & Power Corporation and the other in the town of Elk Grove on the lines of the Western States Gas & Electric Company.

The method of making the tests was similar to that employed in the Northwest range survey, and the same equipment was used. The equipment and manner of making the range tests were fully described in the report of the domestic cooking and water heating committee for 1925-1926, N.E.L.A. publication No. 256-38.

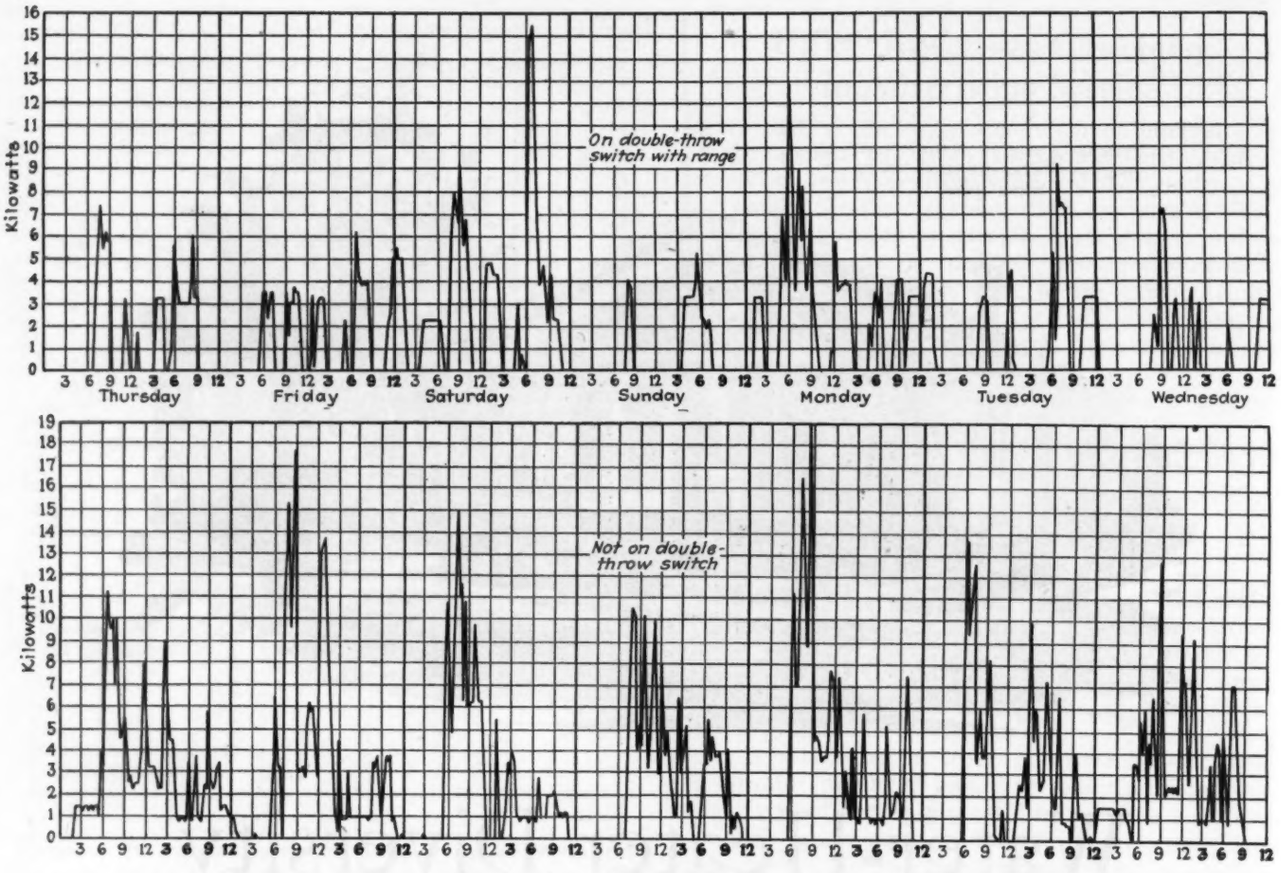
For the purpose of the tests ten large-capacity, metered water heaters were chosen in each of the two towns. The two communities were practically comparable as to size, type and size of houses, size of families and living habits of the people. There were, however, three important respects in which conditions differed. In the town of Elk Grove all water heaters were on a double-throw switch against the entire range, all tanks were well insulated and some water was heated by auxiliary means, such as with furnace coils, whereas in San Joaquin the heaters were not on a double-throw switch, the tanks were uninsulated and all water heating was done with the electric heaters. In both cases the heaters were manually controlled with the exception of one automatic heater

RESULTS OF WATER-HEATER DIVERSITY TESTS AT ELK GROVE AND SAN JOAQUIN

	Elk Grove*	San Joaquin†
Range connected load (kw.)	61	61.96
Water heater connected load (kw.)	31.8	42
Lights and appliances connected load (kw., estimated)	25	25
Total Load Test		
Connected load (kw.)	117.8	128.96
Average connected load per customer (kw.)	11.8	12.9
Average of three highest 15-min. demands in seven-day period (kw.)	17.7	18.2
Diversity	6.65 to 1	7.1 to 1
Total consumption (kw.-hr. in seven days)	680	698
Consumption per day (kw.-hr.)	97.3	99.7
Load factor (per cent)	22.9	22.8
Water-Heater Test		
Connected load (kw.)	31.8	42
Average connected load per heater (kw.)	3.18	4.2
Average of three highest 15-min. demands in fourteen-day period (kw.)	13.7	18.1
Diversity	2.32 to 1	2.32 to 1
Total consumption (kw.-hr. in fourteen days)	491	985
Consumption per day (kw.-hr.)	35	70.3
Load factor (per cent)	10.6	16.2

*Ten customers with water heaters. All heaters manually controlled. All heaters on double-throw switch against range. Nine customers had ranges.

†Ten customers with water heaters. All water heaters with exception of one automatic heater were manually controlled and were not on double-throw switch with range. Nine customers had ranges.



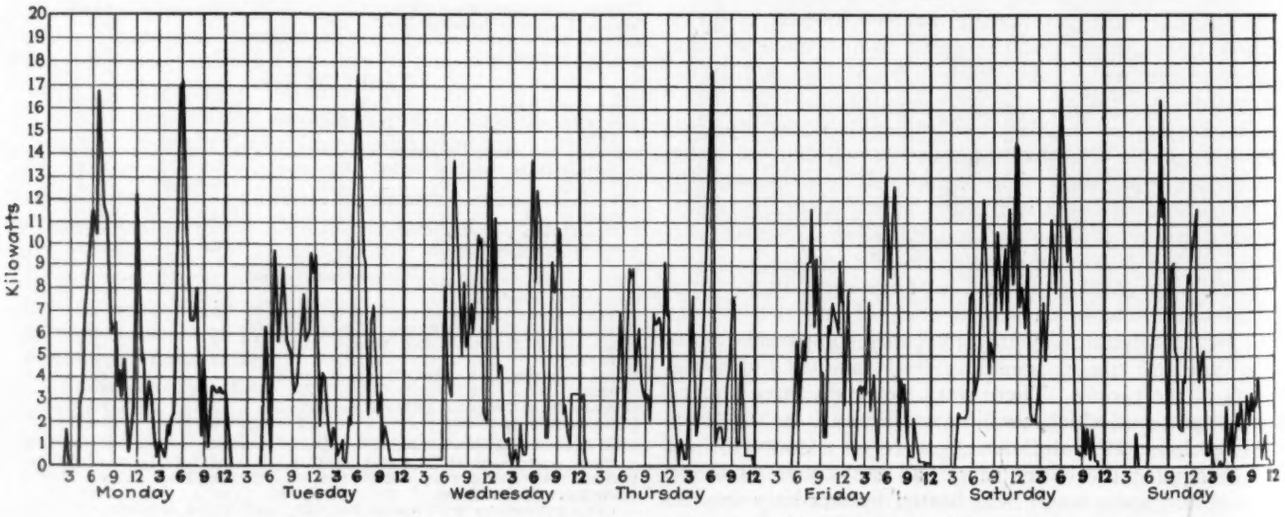
LOAD CHARACTERISTICS OF METERED WATER HEATERS WITH AND WITHOUT DOUBLE-THROW SWITCH AT ELK GROVE AND SAN JOAQUIN RESPECTIVELY

At Elk Grove ten consumers with a connected load of 31.8 kw. were involved and all water heaters were manually controlled. At San Joaquin there were also ten consumers, but they had a connected load of 42 kw. and all except one water heater were manually controlled. Tests were made during weeks starting April 21 and 28 respectively.

in San Joaquin. In each case nine customers had electric ranges.

Results of the two tests are given in the accompanying table. It is strikingly significant that notwithstanding the fact that one group of heaters was on double-throw switch and the other was not, the diversity in each case was identically the same—that is 2.32 to 1. The fact that all the heaters in Elk Grove on double-throw switch were on insulated tanks and that some auxiliary water heating was done might have been expected to improve the diversity, which is further reason for attaching importance to the similarity in diversity. Under these conditions it would naturally be expected that the load factor of the water-heating load in Elk Grove would be less than that in San Joaquin, and this, as will be noted, was the case. Uninsulated tanks and greater use of the heaters were responsible for the fact that the consumption for water heating in San Joaquin was double that in Elk Grove.

The tests were accurate. To what extent results are



TOTAL LOAD TEST SHOWING CHARACTERISTICS OF WATER-HEATER, RANGE AND LIGHTING LOAD AT ELK GROVE

Ten customers were involved having a connected load of water heaters (31.8 kw), ranges (61 kw.) and lights and appliances

a criterion for other communities it is difficult to say. At any rate they give data for the conditions as set forth and for the first time shed definite light on two moot points, the diversity of large-capacity, metered water heaters and the value of the double-throw switch in reducing water-heating demand.

There are, of course, many other types of water heaters and water-heating installations that give rise to numerous combinations. There are twelve variables under four operating conditions that give rise to 60 combinations. These are:

Insulation—Insulation, non-insulated.

Operation—Automatic, continuous, manual and intermittent.

Connection—With double-throw switch, with load-limiting device, directly on the line.

Size—1 kw. to 6 kw.

From a practical standpoint it is out of the question to attempt to test each of these combinations. In making a survey it would be necessary to choose certain conditions that represent practice on utility systems and make deductions from these. To conduct a comprehensive series of tests to yield the information concerning water heating desired by everyone is an engineering problem of some magnitude, but the water heating committee has laid out a program and is ready to proceed with the tests at such time as the expenditure is authorized by the N.E.L.A.

Inspection Method of Determining Depreciation

By W. G. Cross
Assistant Valuation Engineer
Southern California Edison Company, Los Angeles, Cal.

Executive attention has been directed recently to the importance of actual inspection in determining depreciation by an apparent change of attitude on the part of the courts and commissions. Following a discussion, in the Nov. 12 issue, of the use of life tables, Mr. Cross outlines the function of physical inspection according to recent decisions.

DETERMINATION of existing depreciation in a public utility property is usually accomplished by the life table, service unit or inspection method. The last method requires some physical procedure with the item, such as visual inspection, physical or electrical test, or other means of determining tangible or measurable evidence of wear and tear. Ordinarily such a method determines only natural depreciation, although cases can be conceived where action of the authorities might demand certain improved types of electrical material and thus cause functional depreciation of the existing item—a determination that could be made only by a physical inspection or other test.

Although the method is not at all new in general, notice of this procedure has been taken by regulatory commission and court decisions only within the last two years. The attitude existing may be gathered to a certain extent from the following notes abstracted from various decisions:

The West Virginia commission has stated that theoretical estimates of accrued depreciation must give way to facts found by a thorough inspection.[1] The New Hampshire commission has said that the amount of depreciation reserve should be treated only as evidence that there is actual depreciation, and the best evidence is the observed depreciation made by an inspection and examination of physical property.[2] The Idaho commission, in comparing the life-table method and inspection method, avers that use of life tables is too theoretical without inspection of the property, taking into consideration age, special conditions and maintenance expended.[3]

Acquiescence in the inspection method is not universal, however, as the Virginia State Corporation Commission says: "Not all physical deterioration is observable. There may be physical deterioration incident to age and use which exists whether observable or not." Allowance should be made not only for observable depreciation but also for "depreciation inherently incident to age, use, obsolescence, inadequacy, overadequacy, inappropriate engineering layout, etc."[4] This position was sustained by the Virginia Court of Appeals in a later decision.[5]

The United States District Court in the Denver Tramway case says that accrued depreciation is a fact to be ascertained by inspection,[6] and the court in a South Carolina case not only confirms the inspection method but contrasts it with the use of life tables by stating that actual physical examination by competent witnesses is a better guide than theoretical methods such as the straight line method.[7]

The United States District Court, in a Pacific Telephone case in the State of Washington, states that depreciation is the diminution in value that takes place in the physical thing and is ascertained by physical inspection, and is not the future depreciation that inevitably

[1] *West Virginia Public Service Commission re United Fuel Gas Company, P.U.R. 1925B, 705.*

[2] *New Hampshire Public Service Commission re New England Telephone & Telegraph Company, P.U.R. 1926E, 187.*

[3] *Idaho Public Utilities Commission re Boise Water Company, P.U.R. 1926D, 321.*

[4] *Virginia State Corporation Commission re Chesapeake & Potomac Telephone Company, P.U.R. 1926E, 543.*

[5] *Virginia Court of Appeals, 484.*

[6] *Westinghouse Electric & Manufacturing Company vs. Denver Tramway Company, P.U.R. 1925B, 156.*

[7] *Southern Bell Telephone & Telegraph Company vs. Railroad Commission of South Carolina, P.U.R. 1926A, 6.*

comes about.[8] This decision apparently contrasts actual depreciation with depreciation reserve accumulations. The United States District Court for the Southern District of New York stated that, in determining a rate base, the law requires deduction only for actual depreciation, just as actual as the present value, and that the extent of such depreciation must be ascertained by the same kind of evidence—namely, opinion based upon contemporary investigation.[9] However, in a later decision in this action by the New York Public Service Commission, the amount of the depreciation reserve, less certain adjustments, was taken as the measure of accrued depreciation in a rate valuation in preference to observed depreciation.[10]

Sample Method Established

An interesting decision has been rendered by the United States District Court for the Southern District of Ohio in a case where 66 samples of pipe, 6 in. long, were taken from a natural gas system. The amount of pitting and the loss in wall thickness were obtained by very careful examination and measurement and the results determined were applied to the entire system. In commenting on this procedure the court notes that this process took into account no general depreciation on account of age and usage; that the inspection method is entirely proper and decidedly preferable where it can be effected, and that the proportionately small quantity of pipe was proper evidence subject to weight, but that it was by no means of controlling weight. It then added that the element of age is considered as an essential, and apparently produced a figure that took both factors into consideration.

The Supreme Court of the United States has furnished two outstanding decisions relative to the subject of depreciation by inspection, and the wording in each case is almost identical. One is the case of the Pacific Gas & Electric Company versus San Francisco, decided June 2, 1924, and the other is that of McCardle versus the Indianapolis Water Company, decided Nov. 22, 1926. In the Pacific Gas decision, the company insisted that depreciation should have been based upon testimony given by competent experts who examined the structural units, spoke concerning observed conditions and made estimates therefrom. The court noted that these examinations were made with a definite idea of accurately determining the facts and sustained the company in its general contention with the statement that "facts shown by reliable evidence were preferable to averages based upon assumed probabilities." In the Indianapolis decision the Supreme Court makes the statement that "testimony of competent engineers who examined the property and made estimates in respect of its condition is to be preferred to mere calculations based on averages and assumed probabilities."[11] The wording, it will be noted, is almost identical and it is to be presumed that the Supreme Court definitely sanctions the method.

Certainly, sufficient approval has been given the use of this method to establish its legality and reasonableness in determinations of accrued depreciation. Certain provisos are attached, however. As depreciation by inspection must, to a large extent, be based on opinion derived from observed facts, it is essential that the one making the determination must be an expert decidedly familiar with the objects in question. Presumably a man who is customarily engaged in building construction and repair would be the best type of expert to compute and testify to such matters in the case of buildings; a distribution system superintendent in direct charge of erection, replacement and maintenance of lines would be most competent in the case of distribution lines; whereas the superintendent of shops would probably be exceedingly well qualified to determine the internal depreciation of transformers, metering instruments, generators, etc.

[8] *Pacific Telephone & Telegraph Company vs. Whitcomb, P.U.R. 1926D, 815.*

[9] *New York Telephone Company vs. Prendergast, 300 Fed., 822, P.U.R. 1925A, 491.*

[10] *New York Public Service Commission re New York Telephone Company, P.U.R. 1926E, 1.*

[11] *McCardle vs. Indianapolis Water Company, U. S. Supreme Court, 15.*

Utility Company Aids Flooded Areas by Radio Service

AN OUTSTANDING feat in communication during the recent flood in New England was performed by the Edison Electric Illuminating Company of Boston through its 100-watt portable radio broadcasting station WATT and its home station WEEI in Boston. During the flood many points in Vermont were cut off from the rest of the world except for short-wave messages from amateur operators who succeeded at times in reaching outside places. On Saturday morning, Nov. 5, station WEEI was broadcasting messages to persons in the flooded districts asking that they communicate with friends and relatives in Boston. The entire Edison switchboard was tied up with calls and it became necessary to suspend transmitting personal messages, as no replies could be expected. About noon it was decided to send station WATT into the flood zone to bridge the gap in communication. Preparations were rushed and at 5 p.m. the outfit got under way in charge of Manager Charles Burton of WEEI, arriving at White River Junction, Vt., at 8:30 a.m. Sunday after many vicissitudes.

UTILITY'S PORTABLE RADIO STATION IN FLOOD AREA

Parking in front of the Hartford High School, the crew erected an antenna between the flagpole and the school chimney. By means of batteries procured from a local dealer from Lebanon whose stock had been wiped out by the flood, WATT went on the air.

At station WEEI flood news was broadcast at frequent intervals through the worst of the period of interrupted communication. Steps were taken to relieve the gasoline

shortage in Vermont as a result of this activity, and also to augment Boston's milk supply. In some cases critical news was transmitted and much suffering reduced or eliminated. Hundreds of letters and telephone calls were received by WEEI expressing appreciation of the radio service. Lieut. D. S. Boyden of the Edison company, radio adviser to the Signal Corps, established two-way communication with amateur operators in the flooded areas and co-operated with WEEI during the emergency.

Letters from Our Readers

Declares Criticised Test Circuit Duplicated Service Conditions

To the Editor of the ELECTRICAL WORLD:

The letter from C. L. Kasson regarding connections used for tests on alternating-current air circuit breakers is particularly interesting because it questions a procedure which has been used for a number of years by the N.E.L.A., not only for low-tension circuit-breaker testing, but for tests on oil circuit breakers.

In the first paragraph he states that at the start of the opening operation there is practically no potential between the different phases. Before the arc appears it is quite true there is no potential between phases, since the breaker is subjected to this voltage continuously previous to the short circuit. After the arc appears the voltage increases rapidly as the length of arc increases, and the greatest tendency for the arc to break over between phases is at the moment when the current has been reduced practically to zero and the air above the contacts is filled with hot gases.

In the same paragraph the statement is made that there is no initial tendency for the three arcs to intercommunicate. This statement is quite true, although the reason why the arcs do not tend to communicate has nothing to do with the voltage. Any one who has witnessed tests of heavy current, whether they are short circuits or not, will appreciate the tremendous repulsive force between the opposite sides of the circuit-carrying current. This magnetic force drives the arcs apart rather than together. The closer the two are together and the greater the current, the greater will be the repulsive force. The photograph referred to very definitely shows the results of this magnetic force in driving the arcs apart.

In the second paragraph a positive statement is made that the results would have been different with a different circuit arrangement. This was probably intended as an expression of opinion and as such requires no comment. The statement is also made that the load possesses electromagnetic energy, and I agree that there is no doubt that the stored energy in the circuit makes the opening more difficult. However, the strain upon the breaker in opening an inductive circuit is quite independent of its position in the circuit, because the voltage produced by the interruption of current in an inductive circuit must appear across the terminals at the point of interruption.

In the last paragraph the test circuit referred to is a diagram of the connections actually used for tests No. 7, No. 8, No. 9, No. 10, No. 11, No. 12 and No. 15. This includes the short circuit which is shown in the photograph previously referred to, which was of test No. 12. In this case the voltage between terminals on the breaker at the starting of the arc was approximately 230. These tests were considered by far the least severe of any made in the series. In actual operation a circuit breaker is installed at the supply end of a feeder, and short circuits may occur anywhere on this feeder. When the short circuits occur at the distant end of the feeder, the voltage on the breaker is not zero, but the current is quite low. When the short circuits occur almost at the circuit-breaker terminals, the voltage drops practically to zero, but the current is much greater. Long experience has convinced the majority of operators that the second condition, requiring the interruption of the heavy current, is much more difficult to cope with.

Mr. Kasson says that the circuit breakers are normally installed to interrupt power, not current. He has previously stated that the electromagnetic energy of the circuit is difficult to interrupt. When the circuit consists entirely of electromagnetic energy, which is the most difficult circuit to interrupt, there is no power and the breaker is interrupting reactive amperes at the circuit voltage, not kilowatts. The American Institute standard for interrupting capacity of circuit breakers is based on interrupted current on a circuit of a certain voltage and makes no reference to kilowatts. Regardless of whether the amperes are power or reactive amperes, the voltage which tends to cause a re-establishment of the arc or intercommunication between phases is the voltage immediately after the interruption of the circuit, when the space near the contacts is filled with incandescent gases. This voltage is frequently higher than the normal circuit voltage, owing to the inductive effect mentioned.

I express no preference for either air or oil breakers, but I am convinced that the circuit used in making these tests is quite satisfactory for three-phase testing of either type of breaker. Even should a more desirable test circuit be obtained by the connections proposed, it would not so accurately duplicate service conditions, and it would be quite difficult to obtain for any such high currents as those used in these tests, since we have been unable to obtain a source of power with infinitely small impedance which would permit us to put the impedance on the load side of the breaker. TITUS G. LECLAIR.

Commonwealth Edison Company,
Chicago, Ill.

Who Will Rechristen the Oil Burner?

To the Editor of the ELECTRICAL WORLD:

There's much in a name. In an editorial in the Nov. 12 issue of the ELECTRICAL WORLD you make an appeal for a better name than "oil burner" for that "splendid domestic labor-saving device," and every one will surely support your appeal. There *is* much in a name—as those power men who have struggled with "inductive interference" cases know. During the New York plenary meetings of the International Electrotechnical Commission in April, 1926, much use was made of the terms "dangerous" and "very dangerous" wires, during the discussions of safety "crossings" regulations. The writer then suggested that, in view of the great and successful efforts which had been made to make these crossings safe, the use of those terms be discontinued and that they be replaced by others which, at least, would not put an outlaw's brand upon wire crossings before any consideration at all had been given to them.

Your appeal against spreading the use of the name "oil burner" seems to me to be along such reasonable lines that I trust it will meet universal support.

Department of Railways and Canals,
Ottawa, Canada. JOHN MURPHY.

Digest of Electrical Literature

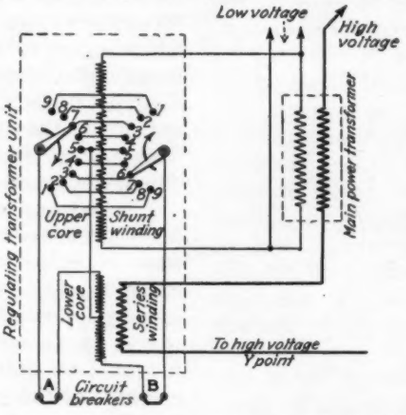
Hydro-Electric Development and Steam Equipment

Design of Large Low-Pressure Conduits.—H. H. BURNESS.—Considerations designed to effect the minimization of excavating and constructional labor and material for open-channel or conduit work are dealt with in this discussion. The question of constructing a closed conduit of the most economical cross-section involves the design of one in which direct stress or tension is the only stress encountered. The author says that the shape should be that assumed by a flexible inextensible membrane when filled with liquid under the particular conditions involved. In an endeavor to develop such a cross-section a somewhat mathematical discussion and procedure and a detailed tabulation of costs have been utilized. Various conditions of pressure and flow may be substituted to secure the formula and cross-section for use in any specific problem. —*Engineering (England),* Nov. 11, 1927.

Transmission, Substations and Distribution

Hydraulic Drive for Induction Regulator. — P. SUTER. — The customary motor drive for the angular setting of the rotor on induction-voltage regulators usually requires between 20 and 45 seconds for the full range. In some networks it was found desirable to cover the regulating range in four to five seconds. For such quick action the customary motor drive is unsuitable, and a Swiss concern has developed a hydraulic or servo-motor drive similar to the speed regulators used on water turbines. A small motor continuously drives two oil pumps of the gear type, which force oil under pressure against both sides of the operating piston. An electromagnetically operated valve releases the oil pressure on one or the other side of the piston, depending upon the desired regulation. A small radiator is required to keep the temperature of the circulating pressure oil to a permissible level. If the regulator stands in a radiator type tank, one of the radiators is piped to the servo-motor oil.—*Brown, Boveri Mitteilungen,* September, 1927.

Application and Design of Load Ratio-Control Equipment.—ARTHUR PALME.—Load ratio control of transformers, which means the possibility of changing the transformation ratio without neglecting the load, has enjoyed rapid adaptation because of the wide possibilities of application. It provides a long-sought solution for voltage regulation on industrial loads and large blocks of power and enables a satisfactory tie-in operation of two or more power systems with any desired load dispatch regardless of voltage or power factors. It is stated to be the only economical method known to operate extended transmission systems on an equipotential basis. The author has endeavored to give the various possible applications and some details of the electrical and mechanical design of the apparatus. The three best known of the several methods by which the ratio of primary and secondary voltage of a transformer may be changed without interrupting the load are discussed in this article. The progression method is that in which the taps of the winding are connected to a straight row of contacts over which glides a double brush; the multiple-switch method is a modification of the previously mentioned one in which each tap is connected to an



LOAD RATIO-CONTROL PLAN USING POWER TRANSFORMERS WITH SEPARATE REGULATING TRANSFORMER

external oil switch, and the double-circuit method is one in which the transformer is equipped with a double winding, each with the required taps for its own ratio adjusters. In the latter case by means of external oil switches one and then the other half may be rendered inoperative for its tap change. —*Journal of American Institute of Electrical Engineers,* November, 1927.

Illumination

Results of Practical Experiences in Photo-Electric Photometry. — W. F. LITTLE AND C. E. HORN.—The photo-electric cell photometer has proved thoroughly practicable, and its many advantages have made it indispensable for certain work. An exposition is offered of the experiences encountered in the use of this instrument in the Electrical Testing Laboratories on integrating spheres for the measurement of incandescent lamps by the spectrophotometer, when measuring the transmission of light through filters, and on the distribution photometer. This discussion covers integrating photometers, the accuracy of use and the devices necessary to secure color corrections, the range and adaptability for various purposes, the equipment for seasoning the lamps used in the device, the candlepower distribution photometer and the spectro-photometer. *Transactions Illuminating Engineering Society,* 1927.

Asymmetric Light Distribution Requirements for Side-Mounted Street-Lighting Units.—ARTHUR J. SWEET and THOMAS W. ROLPH.—The asymmetric light distribution requirements for street-lighting units mounted on the side of the street are analyzed. These requirements are studied throughout the range of mounting heights, transverse location of units and street widths characteristic of street-lighting practice in the United States. It is found that two types of asymmetric distribution will meet the present needs of the service. Each of these types is exactly defined. A simple means is proposed for selecting the proper type of asymmetric distribution in the design of street-lighting installations. The relations between variables in installation conditions receives particular attention, and the determination of lateral angle cut-off on the near side of the street has been developed as a special item.—*Report to Illuminating Engineering Society,* October, 1927.

Units, Measurements and Instruments

Impulse Voltage Equipment.—A Swiss manufacturing firm has devised equipment which furnishes impulses up to 300 kv. in intensity for the testing of high-voltage apparatus under impulse voltage. A single-phase, high-voltage transformer is connected through four vacuum valve tubes to a spark gap. The oscillating circuit, comprising two condenser batteries and a high resistance, is placed in parallel with the gap. The tested object is placed in shunt with the resistor. The air condensers consist of large wire-screen frames mounted on insulators close to each other. The whole set of condensers is mounted outdoors on the roof of the testing building. The value of potential rise from zero to its maximum is about one-tenth of a micro-second, corresponding to that of a sinusoidal oscillation of about 2,500,000 cycles per second. It is claimed that this type of air condenser is more resistant to puncture than the customary glass or liquid dielectric design.—*Bulletin No. 73, Oerlikon (Switzerland),* 1927.

Relation Between Frequency and Spark Overvoltage in a Sphere-Gap Voltmeter. — L. E. REUKEMA. — The standard instrument for measuring crest values of high alternating voltages at 60 cycles is the sphere-gap voltmeter, which measures a voltage by the flashing

distance between spheres. High frequencies are, however, used in much of the high-voltage research work, and for these tests the sphere-gap voltmeter is also utilized, the assumption being made that calibration at high frequency is little at variance with that at 60 cycles. In an endeavor to make the sphere gap a standard for measuring peak values of voltage at high frequencies experimental data were obtained from which calibration curves for the sphere-gap voltmeter were plotted for frequencies ranging from 28,000 cycles to 425,000 cycles per second for standard conditions of temperature and pressure. As the result of these tests it is concluded that the effect of high frequency is to decrease the voltage necessary to flash across a given gap between spheres. The effect of ultraviolet light is to reduce the voltage necessary to produce the flashover. A complete set of calibration curves for the frequency range covered was obtained for the spheres when flooded with ultraviolet light.—*Report to American Institute of Electrical Engineers,* September, 1927.

Electrophysics, Electrochemistry and Batteries

Current Distribution in Supraconductors.—F. B. SILSBEE.—The author analyzes in detail the electrical conditions to be expected when a tube of supraconducting material is subjected to the action of the magnetic field both from a current flowing in the tube and also from a current flowing in a wire lying along the axis of the tube. The results are compared with the data experimentally obtained by other investigators. The agreement noted supports the assumptions on which the theoretical work is based. The essential element of these experiments is a system of conductors consisting of an outer hollow circular cylinder of supraconductive material and of a slender straight inner conductor coaxial with the tube. Currents are established in the inner and outer cylinders, and the problem is to find the electric potential gradient in the outer conductor and, incidentally, the current density and magnetic field intensity at various points in the cross-section of the cylinder. A complete solution of the problem would involve a consideration of the time element and the working out of the theoretical history of the several variables throughout the course of the experiment. Such a plan has not been attempted in this work. In this instance material was regarded as a continuous isotropic medium, free from Hall effect. The currents were considered constant in time; that is, transient phenomena were disregarded. The conductors were assumed to be infinitely long and the system was considered to be symmetrical about its axis. In conclusion it is stated that in a certain sense the hypothesis of the correspondence of critical currents and critical field cannot be established by a crucial experiment. The hypothesis is equivalent to the statement that a critical current will not be found except under conditions where a magnetic field is sufficient to account for the restoration of resistance. Any single experiment which did demonstrate such a saturation current in the absence of appreciable magnetic field would be a crucial disproof of the hypothesis. On the other hand, any number of experiments like the present ones, in which an apparent critical current can be accounted for by the magnetic field, cannot suffice to prove the hypothesis for all possible cases. It is stated that data were obtained with a distribution of magnetic field closely similar to that in any conductor carrying a current and that the results could be completely explained without making use of the concept of critical current. — No. 556, *Scientific Papers of the Bureau of Standards.*

Telegraphy, Telephony, Radio and Signals

Propagation of Periodic Currents Over a System of Parallel Wires.—JOHN R. CARSON and RAY S. HOYT.—A discussion of the formal mathematical theory of the propagation of periodic currents over a system of parallel wires energized at its physical terminals only is set forth in the first part of this article. The theory developed is essentially a generalization of the classical theory of transmission over a single wire, with ground return, or over a balanced metallic circuit. The solution which is given here furnishes the fundamental formulas and a good deal of information regarding what takes place in a system of parallel wires. The analytical solution of the problem of propagation over a line or a circuit exposed throughout its length to an arbitrary impressed field of force is also considered. The latter portions of the work are devoted to the development and application of a more physical or synthetic method of treatment, based on the substitution of equivalent electromotive forces for the arbitrary impressed field. This synthetic treatment, which permits of an intuitive or physical grasp of the various problems, has been found useful in dealing with such difficulties as cross-talk and interference on telephone lines and also with wave antenna. —*Reprint No. 262, Bell Telephone Laboratories.*

Electromagnetic Waves Guided by Parallel Wires.—S. A. LEVIN.—A theory of the propagation of electromagnetic waves guided by a system of parallel wires is developed with particular reference to the effect of the earth and is simplified so that it is identical in form with the elementary theory. Important general properties of a system of parallel conductors and their application to problems of propagation in power or communication circuits, or in a system of both types of circuits, as derived by Professor Pleijel from the elementary theory, are mentioned, accompanied by several remarks of practical importance. The simplified theory gives promise of successful application to such problems of propagation in transmission systems as have not been formulated heretofore with sufficient precision. — *Journal of American Institute of Electrical Engineers,* November, 1927.

Miscellaneous

Lubrication of Surfaces Under High Loads and Temperatures.—T. E. STANTON.—It is pointed out that many previous experiments with lubricating problems are applicable only in cases where the film of lubricant is of such a thickness that the unknown boundary conditions do not enter into the solution of the problem and the results may, therefore, be deduced from the equations of hydrodynamics. When the surfaces are so close together that this condition no longer holds, a state of boundary lubrication is said to exist, the laws of which have been successfully investigated by several other experimenters. According to the author it is now known that the frictional resistance of surfaces moving over each other, under conditions of boundary lubrication, is no longer a function of the dimensions of the surfaces and the viscosity of the lubricant, as in film lubrication, but depends on the nature of the two surfaces and the chemical constitution of the lubricant. The present discussion directs attention to the very large difference in the frictional resistance between surfaces under the two sets of boundary conditions. Recent experiments at the National Physical Laboratory have been devoted to investigation of the importance of the eccentricity of loading assumed under various adjustments and concentration of mass upon the journal. The main conclusions derived from the tests are that the known merit of castor oil in preventing failure of bearings running hot is not due to inability to seize, but is due to the low value of the coefficient of friction under boundary lubrication conditions; that it is possible to obtain a straight mineral oil which maintains itself in the film condition up to temperatures far in excess of the limiting temperature for castor oil, and that mineral oils of the same degree of acidity and unsaturation, and for which the values of the viscosity and density are approximately the same, may vary greatly in their capacity to stand up under high temperatures in film lubrication. Oils which possess exceptional lubricating properties under boundary lubrication conditions are not necessarily the best for purposes of film lubrication. This leads to the conclusion that in a search for a lubricant which will enable a machine to run at really high temperatures and at a high efficiency under film lubrication it is not only the chemistry of the lubricant, but its physical properties, which must be studied.—*Engineering (England),* Sept. 2, 1927.

Book Reviews

Theory of Thermionic Vacuum-Tube Circuits

By Leo J. Peters. New York: McGraw-Hill Book Company, Inc. 256 pages. Price, $3.

The behavior of three-element vacuum tubes and the equations of that behavior are the subject matter of this book. The author does not attempt to cover all of the possible circuit combinations in which triode tubes may figure, but takes the characteristic curves as a starting point and develops methods by which the performance of the device in a given electrical circuit may be calculated. After discussion of elementary thermionic and amplifier theory, the idea of neutralization of resistance is introduced. Then come chapters on the generation of sustained oscillations, behavior of radio receiving systems, triode equation under various circuit conditions, modulation and demodulation, and theory and design of amplifier circuits. A large part of the progress in that, so far, principal field of use of vacuum tubes, the radio art, has been made by experimenters whose labors have, perhaps, been more smiled upon by fortune than aided by exact knowledge. However, after the first exploitation of a new field there comes a period of co-ordination and statement of the facts thus far experimentally determined, and it is on the foundation of such co-ordinations and statements that future progress is built. Professor Peters' book is a worthy and valuable stone in that foundation.

Der Transformator in Betrieb

By Milan Vidman. Berlin: Julius Springer. 310 pages, 126 diagrams.

A machine does not merely have to be built, it has to be operated. Operation makes certain demands; the designer plans for the attainable and rejects those impossible of fulfilment. Not knowing what conditions may arise in the exigencies of service, he sets the severest ones his equipment can be made to meet and builds accordingly. At that point his control ceases. The operating or plant-designing engineer, then, confronted by the diverse problems of operation, must know intimately the resources thus placed at his disposal. He must weigh economic considerations, balancing first cost against economy of operation under the peculiar conditions of a given situation. He must distinguish between the dissimilar requirements of power and lighting loads; he must be familiar with the effects of overload currents, of overvoltage, of the abnormal strains due to transients arising from short circuits, grounds, switching operations and lightning.

The performance of a transformer is intimately related to that of apparatus associated with it. Wise choice and intelligent operation of the former are impossible without bearing this in mind. In this view the author, a transformer designer of many years' experience and latterly an operating engineer, discusses some problems of transformer selection and operation frankly, and at times with vigorous criticism of false economy, misguided specifications and other ill-advised practices. Mathematical analyses are not avoided, though used with moderation, and when used are generally made specific by a numerical example.

Annual Report of the Federal Trade Commission

Washington, D. C.: Government Printing Office. 108 pages, paper. For free distribution.

New conceptions of the part the Federal Trade Commission should occupy in the commercial life of the nation have come into being recently and have resulted in far-reaching developments. The new policies have principally to do with the idea of self-regulation in business and industry, and it has been found possible to progress in these directions without overstepping the bounds of the commission's powers as laid down by law. "Helping business to help itself" wherever and whenever it can be done consistently, without prejudice to the best interest of the people as a whole, is the principle of the new policy.

The commission is applying this idea in many ways. A new constructive agency known as the "trade practice conference division" is proving of substantial assistance to the commissioners and their force of attorneys, economists and investigators in the fundamental work of the body—the elimination of unfair practices in commercial competition. Co-operation with business is also carried on by the commission through a recently adopted practice permitting a prospective respondent to have an informal hearing by the board of review before a complaint is issued. A third measure is one permitting minor cases to be settled in the public interest by stipulation. This means that a firm complained against may agree to discontinue alleged unfair acts and thereby dispense with the necessity for issuing a formal complaint, with the usual attendant expense of time and money.

Engineering Problems Manual

By F. C. Dana and E. H. Willmarth. New York: McGraw-Hill Book Company, Inc. 187 pages, illustrated.

This is a text for freshmen and sophomores in engineering colleges. It consists of a series of problems in general engineering fields and gives with each problem list some fundamental data for use in their solution. It is a problem review of mathematics and physics and is meant to co-ordinate the subjects taught in preparatory courses and in the early college courses. The problems are practical and well chosen and the book should prove very useful.

Alternating-Current Machinery

A Textbook in the Theory and Performance of Generators and Motors. By Richard E. Brown. New York: John Wiley & Sons. 273 pages, illustrated.

The author of this book developed notes until he reached the stage where a textbook could be written which met the treating specifications in his course. The result is a thoroughly good type of text where a logical sequence is used, where words are subordinated to a few fundamental equations and graphs and where good problems are incorporated at the end of each chapter. This method has boiled down into a comparatively few pages the fundamentals of alternating-current circuits and machinery, leaving room in addition for a treatment of rectifying machines and devices.

If a capable teacher uses this book as an outline, and if students grasp the physical meaning underlying the mathematical equations, there is no doubt that effective results will follow. With a subject of such broad scope and with such a variety of types of machines, it has become difficult in the normal college course to treat thoroughly and at length each type of machine. As a consequence two schools of teaching have developed. In one, represented by this book, a logical treatment is had by outlining the basic equations for each machine. In the other an attempt is made to generalize on a few fundamental conceptions of electrostatic, electromagnetic and electric circuits which apply to all machinery and little effort is made to go into detail concerning any particular type of machines. Judged by results both methods are successful. This text is well constructed, and the book is sure to be used largely in American colleges.

Book Note

AMERICAN SOCIETY FOR TESTING MATERIALS TENTATIVE STANDARDS. Philadelphia: American Society for Testing Materials. 824 pages, illustrated. Price, paper, $7; cloth, $8.

Contains 175 tentative standards, 21 relating to rubber products, insulating materials and textile materials.

Books Received

Electrical Supply Regulations and Electrical Wiring Regulations, Dominion of New Zealand. Two volumes in one. Wellington, New Zealand: Department of Public Works. 246 pages, illustrated.

Electrical Engineering Practice, Vol. II. By J. W. Meares and R. E. Neale. New York: John Wiley & Sons, Inc. 532 pages, illustrated. Price, $6.50.

The Propagation of Electric Currents in Telephone and Telegraph Conductors. By J. A. Fleming. New York: D. Van Nostrand Company, Inc. 422 pages, illustrated. Price, $8.

News of the Industry

Illness of Senator Walsh Delays Resolution

Interstate Commerce Committee of Upper House Will Decide on Justification for Proposed Inquiry and on Its Scope and Powers if Authorized

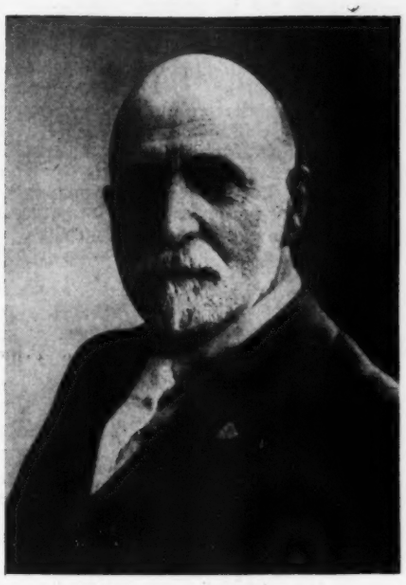
BECAUSE of illness, Senator Walsh of Montana was not able to be in attendance at the opening of Congress on Monday last. The introduction of his resolution providing for an investigation of the electric power industry will await his return to the Senate. He hopes to be present next week, but there is a possibility that he may have to undergo an operation for the removal of his tonsils, in which case his presence in the Senate would be delayed longer.

While the Senate usually is ready enough to pass resolutions for investigations, strong objection arose at the last session to the passage of such resolutions until they had been reported upon by the committee having jurisdiction. Several senators state that they will insist on this procedure being followed in the case of the Walsh resolution. The committee having jurisdiction over a resolution such as that proposed by the Montana Senator is the interstate commerce committee, of which Senator Watson of Indiana is chairman. The committee will have to judge from the facts that Senator Walsh will present whether or not the investigation is justified. If such a decision should be reached, it then will be necessary for it to determine the nature and scope of the inquiry. Another important point will be to prescribe the powers which the investigating committee will be allowed to exercise.

A.S.M.E. Chooses Dow

Detroit Edison's President to Head Mechanical Engineers—Dean Kimball Makes Optimistic Prophecy—Central-Station Topics

ONE of the first actions of the American Society of Mechanical Engineers when it met in New York last Monday for its forty-eighth annual convention was the confirmation of the new officers selected to head the society. The presidency went to Alex Dow, president Detroit Edison Company and one of the four or five outstanding executives in the electric light and power industry. He succeeds Charles M. Schwab. The vice-presidents chosen were John H. Lawrence of New York, E. A. Muller of Cincinnati, Newell Sanders of Chattanooga and Paul Wright of Birmingham.



ALEX DOW

The Melville medal, awarded for the first time, was given to Leon P. Alford of New York. Mr. Alford, editor of *Manufacturing Industries* and active with Herbert Hoover in the organization of the American Engineering Council, received the medal for his paper on "Laws of Management."

Dean Dexter S. Kimball of Cornell University, speaking on Monday for the management division, foresaw future human progress based on increased productivity. "For the first time since the world began we are in touch with the abolition of poverty through the tremendous output of our products," he declared.

George H. Ashman of the General Electric Company, J. R. Weaver of the Westinghouse Electric & Manufacturing Company, W. H. Chapman of Harrison, N. J., and others took part in a symposium on plant and equipment maintenance. A central-station power session was scheduled for Thursday, at which A. E. White and C. L. Clark of the University of Michigan, E. G. Bailey of Fullerton, Pa.; Henry Kreisinger of New York and T. E. Purcell, general superintendent of the Duquesne Light Company, Pittsburgh, were to speak, in addition to G. B. Collier of New York, S. A. Moss of the Thomson Research Laboratory, General Electric Company, and John L. Cox of Philadelphia.

President Gives Small Space to Power

Advocates Disposing of Muscle Shoals and Applying Revenues to Fertilizer Research—Opposes Government Selling Power Generated at Boulder Dam

PRESIDENT COOLIDGE sent to Congress on Tuesday his annual message, a long document covering many subjects. Only a paragraph or two were devoted to the two topics that continue to agitate those who wish the government to enter the power business—Muscle Shoals and Boulder Dam. Concerning the former the President said:

"The last year has seen considerable changes in the problem of Muscle Shoals. Development of other methods shows that nitrates can probably be produced at less cost than by the use of hydroelectric power. Extensive investigation made by the Department of Agriculture indicates that the nitrate plants on this project are of little value for national defense and can probably be disposed of within two years. The oxidation part of the plants, however, should be retained indefinitely. This leaves this project mostly concerned with power. It should, nevertheless, continue to be dedicated to agriculture. It is probable that this desire can be best served by disposing of the plant and applying the revenues received from it to research for methods of more economical production of centralized fertilizer and to demonstrations and other methods of stimulating its use on the farm, but in disposing of the property preference should be given to proposals to use all or part of it for nitrate production and fertilizer manufacturing."

Mr. Coolidge, who is understood to think that the failure so far of the Colorado River Basin states to agree on a plan for the regulation of that river need not prevent congressional action, referred to that matter in these words:

"Legislation is desirable for the construction of a dam at Boulder Canyon on the Colorado River, primarily as a method of flood control and irrigation. A secondary result would be a considerable power development and a source of domestic water supply for southern California. Flood control is clearly a national problem, and water supply is a government problem, but every other possibility should be exhausted before the federal government should become engaged in the power business. The states which are interested ought to reach mutual agreement. This project is in reality their work. If they wish the federal government to undertake it,

they should not hesitate to make the necessary concessions to each other. This subject is discussed in the annual report of the Secretary of the Interior."

"The Columbia River Basin project," the President adds, "is being studied and will be one to be considered at some future time." He mentions also, with apparent approval, the reports of the War Department's board of engineers and the joint board of engineers representing Canada and the United States in favor of the St. Lawrence navigation project, with which hydro-electric plans are entwined.

Work Still Favors Lease of Boulder Dam Water

Paragraphs from the report of Hubert Work, Secretary of the Interior, which refer to the Boulder Canyon project follow:

The interest of the federal government is based primarily on the fact that the stream is not only interstate but international, that several federal reclamation projects have been constructed and secure their water from this stream, and the fact that the development involves flood control, irrigation, power development and domestic water to a very large area. Of perhaps primary importance is the protection from floods of Imperial Valley in California and the Yuma reclamation project in Arizona, with their large investments and tremendous agricultural resources. Incidentally, the same storage will provide water for irrigation of large areas of fertile arid lands and domestic water for southern California.

Engineers and economists have reached the conclusion that the receipts from irrigation, domestic water and hydro-electric power developed at such a structure would, in a reasonable period of years, return the entire cost. The primary development and sale of hydro-electric power by the government is not consonant with the policy of the department, but its subsidiary development at storage dams brings a direct reimbursement for federal expenditures in constructing projects and often supplies electricity for homes, agriculture and municipalities not available from other sources.

As indicated, the problems are so numerous and varied that interstate and international compacts or treaties were deemed advisable. While the matter was the subject of a bill which received long and careful consideration in Congress during the last session, such compacts have not been finally consummated. In fact, at present writing contentions are made by some which, if maintained, might leave the federal government without reason to expend further time and money in connection with the project. If the rights and privileges incident to such project are purely local and intrastate, there would appear to be no warrant for the expenditure of federal moneys for its construction. If, however, as was the view when the departmental investigations and reports were made and the legislation proposed in Congress at its last session, the federal government has rights and interests, the whole matter should receive further consideration.

These storage works being not only of interstate character but also vital to public interest in their phases of flood control, irrigation and domestic water supply, and especially in the protection of our international water rights, I deem that the dam should be constructed with federal aid and under federal control. Moreover, the federal government should in all prudence endeavor to recover the cost from the power potentialities and other revenues. Lease of the rights to use the water to the highest bidders would be the simplest and best means of reimbursing the federal government for its outlay.

I have suggested that if it should prove that no adequate lease could be secured from parties willing to undertake generation and distribution, then the government should have authority to erect the power plant and lease the plant itself, and I have considered that if no adequate contract of this character could be made, then the government should have authority to generate and sell the power at the generating station to persons willing to purchase it and provide their own transmission and distribution.

Cost of Generating Power at Boulder Dam

Joint Committee of National Utility Associations Finds that Government's Revenue Would Not Pay the Bare Interest on the Development.

DECLARING that about ten years would be required to load completely the Boulder Dam hydro-electric plant contemplated in the Swing-Johnson bill after the ten-year period of construction had elapsed, thus deferring for twenty years the full earning power of the project, the Joint Committee of National Utility Associations in a document just distributed says:

"Meanwhile the power from Boulder Dam absorbed by the growth of demand in southern California could be sold at a price which would be substantially equivalent to the then total cost of steam power generation, which would result in a figure of not more than 2 mills per kilowatt-hour at Boulder Dam. In other words, Boulder Dam power as fuel replacement will return the government nothing. As power for new load it will return not more than 2 mills per kilowatt-hour. This 2-mills price would not pay the interest on that development, to say nothing of operating charges and amortization."

This statement, which follows an analysis of the cost of steam-produced power in southern California, of transmission costs and of the rate of market growth, is predicated on the following conclusions affirmed by the committee's investigators:

"First—During the period of six or seven years that the Swing-Johnson bill has been before Congress the cost of generating electrical energy from steam plants has been very materially reduced, owing to the unprecedented increase in the efficiencies of steam turbines and high-pressure boilers. Further improvement is in sight.

"Second—It is now generally conceded that the cost of the large Boulder Dam project will be not less than $200,000,000, as contrasted with the appropriation of $125,000,000 provided."

Utah Fact-Finding Commission Studies Colorado Power

Three reports containing conclusions and recommendations have already been issued by the Colorado River Fact-Finding Committee organized by the Utah Associated Industries and the Utah State Farm Bureau, of which committee James J. Burke, a Salt Lake City engineer, is chairman. The first report outlines a preliminary course of procedure; the second deals with protection to the Imperial Valley from floods, pointing out that this is an international question involving Mexico, and the third is concerned with water supply and power.

The committee found that not only are present power requirements in the Colorado basin met, but that there remains a substantial power surplus in southern California. It reports that railroad electrification would require only a small proportion of the power generated at a plant on the Colorado River. Rates, it found, had a downward trend. The committee doubts whether Colorado River power could compete in cost with power generated from steam in southern California at the present time, without giving any consideration to decreasing cost of steam-generated power. It concludes its study of the power situation with the statement that "the committee failed to find any condition or hopeful signs that seemed to justify or warrant any corporation, public or private, to hazard a long-time contract for this proposed new power."

Newcomb Makes Rejoinder to Pinchot

Commenting on Gifford Pinchot's open letter to Senator Walsh (see ELECTRICAL WORLD for Dec. 3, page 1164), Josiah T. Newcomb, counsel of the Joint Committee of National Utility Associations, said this week:

It is evident that the professional critics of the electrical industry have shifted their ground. The charge last winter was that a single interest dominated the entire industry. This was disposed of by the official report of the Federal Trade Commission. After two years of thorough investigation the commission found to the contrary. The new charge is that five men or interests control four-fifths of the electrical output. This is quite as absurd as the original charge. The facts are fully set forth in the Federal Trade Commission's report, which finds that no single interest or group controls as much as 10 per cent of the output and that there is no evidence of combination control between the respective groups.

Modern methods of mass production and modern financial methods resulting in widespread investment by the public in industrial enterprises have, of course, affected the electrical as well as most other industries. Its independent units have increased rapidly in size. But the tendency has been away from monopoly, not toward it. The increased size and consequent increased efficiency and resource of the independent units have produced results favorable both to the public served and to the investing public.

"Electrical World's" London Letter

Newspapers and Campaigns Help to Keep Electricity to the Fore—Progress of the Reorganization of Supply—Hindrances to Rural Development

By Bernard C. Holding
Editor of "The Electrician"

London, Nov. 15.

IN ENGLAND we are favored with a newspaper press which regards any electrical development as news. While this sometimes has its drawbacks—as instance the mistaken views circulated in this way that the national scheme for the interconnection of electricity supply networks would permit electricity to be sold for all purposes at ½d. per unit!—its value in developing popular interest in electricity easily outweighs such disadvantages.

October opened with electricity very much in the public eye, newspapers throughout the country devoting many columns of space to electrical matters. There were two reasons for this. First was the launching by the Electrical Development Association (which corresponds to the Society for Electrical Development) of the second of its co-operative educational campaigns. Known as the "circle campaign," this effort depends on the activity of what are called electric circles, which resemble your electric leagues. Each of these circles, of which there are about one hundred, is responsible for promoting a number of activities, such as demonstration electric houses, direct mail publicity, electrical lectures, special window displays and house-to-house canvassing in its own area, while the central organization supports the nation-wide effort by means of extensive advertising. The national slogan is: "For health's sake use electricity." A good start to the campaign was insured by the holding on the same day and at the same time of about forty separate public luncheons, at each of which a stimulating electrical message from Sir James Devonshire, president of the Electrical Development Association, was read.

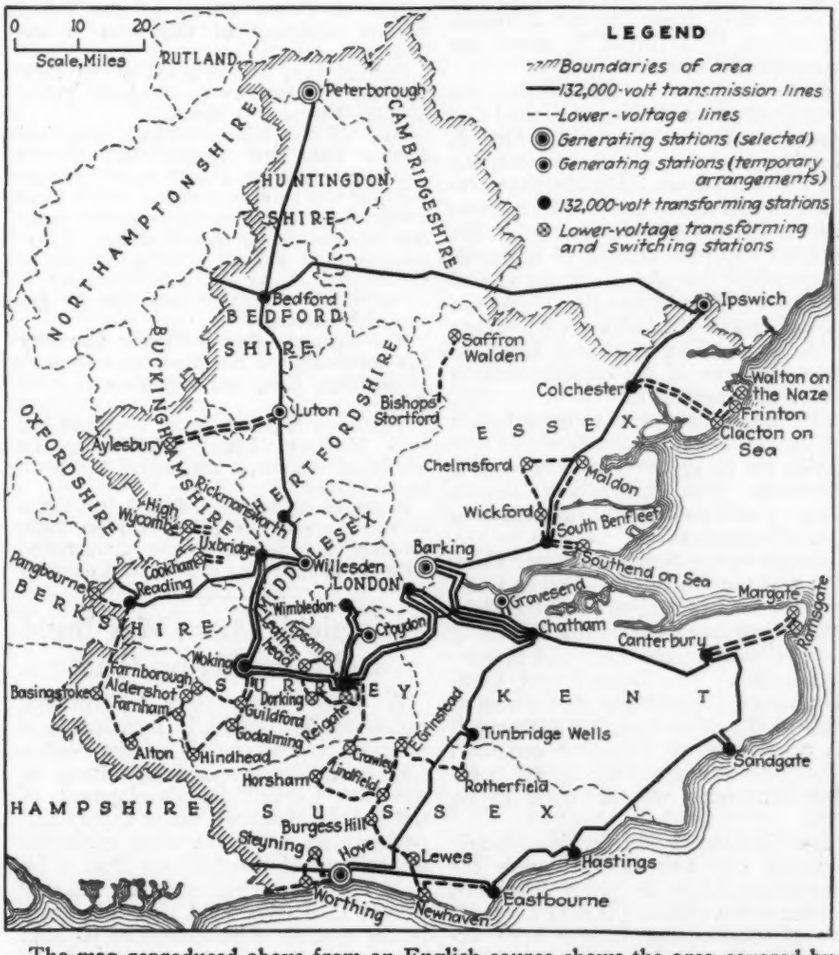
This message secured wide newspaper publicity, and before the story had cooled the electricity commissioners issued the second of their schemes for the reorganization of electricity supply in accordance with the provisions of the electricity (supply) act, 1926. By it the whole of the densely populated districts of southeast England, with an area of 8,828 square miles and a population of nearly 11,500,000, are affected. This area now has 135 generating stations giving a public supply, and the scheme reduces this number to 30. Besides extensions of some of the remaining stations, three additional stations will be erected before 1940. With regard to cost, it is estimated that the erection of the primary transmission system will require about £6,500,000, with a further expenditure around £5,500,000 on extensions of generating stations, etc. When the full advantages of the scheme become operative, it is claimed that an annual saving of about £500,000 in capital expenditure will be effected. One of the best expositions of the national interconnecting scheme—here called the "grid"—was that which Archibald Page, chief engineer to the Central Electricity Board, gave in his presidential address to the Institution of Electrical Engineers. He explained the need for and purpose of the "grid," which is expected to go a long way toward insuring the universal availability of electric power throughout the country.

In view of recent minority agitations against the defilement of the countryside by ugly transmission towers, it is of interest to record that special attention has been given to the general appearance of the lines and their effect upon the landscape, and the form of the towers was settled in consultation with an eminent member of the Royal Academy. The towers will be about 80 ft. high and 16 ft. square at the base, and each three-phase line will have a carrying capacity of 50,000 kva. at 132,000 volts between phases. The conductors will be spaced 12 ft. apart vertically and will for the first scheme—which affects Scotland—be of steel-cored aluminum, with a diameter of 0.77 in., equivalent to copper of 0.75 sq.in. section.

During the month the Yorkshire Power Company inaugurated the first section of a new generating plant at Ferrybridge, with an initial capacity of 38,000 kw. in two units, thus bringing the total installed capacity up to 91,500 kw.

One of the greatest hindrances to the rapid development of electricity supply in rural areas has been the ease with which small local government bodies can inflict unnecessary and sometimes heavy expense on supply undertakings requiring way leaves for overhead lines. Then there is the Post Office, which possesses autocratic powers to order the elaborate guarding of power lines in the vicinity of telegraph or telephone wires. Efforts are now

Part of Plan for England's New Electric System



The map reproduced above from an English source shows the area covered by the electricity scheme for London and southeast England presented by the Central Electricity Board to the electricity commissioners.

being made to arouse a strong public opinion on this matter, and though the obstinately obstructive possibilities of parochial bodies are not underestimated, concerted action may in time minimize their bad effects.

Purchases and Mergers

U. G. I.-Philadelphia Electric Consolidation Is Approved by Stockholders —Duke Power Company Absorbs Southern Power and Great Falls Branches

ANNOUNCEMENT was made on Dec. 1 by a committee of directors representing Philadelphia Electric Company shareholders that more than 66⅔ per cent of the outstanding capital stock of that company had been deposited under the plan of exchanging two shares of Philadelphia Electric for one share of the United Gas Improvement Company (see ELECTRICAL WORLD for Oct. 1, page 699), and that therefore the agreement entered into by committees of the two companies had been declared operative. It was also stated that the time for depositing stock under the agreement had been extended to Dec. 30. There are outstanding 3,718,-121 shares of Philadelphia Electric stock, and although the committee did not make public the exact number of shares deposited, it was generally understood that approximately 3,000,000 shares had been turned in when the statement was made.

Approval of the arrangement was also given at a special meeting of United Gas Improvement stockholders held Dec. 7, when the capital stock of that company was increased from 2,130,088 shares to 6,000,000 and the directors were authorized to issue 1,859,061 shares of the stock, or any part thereof, in exchange and payment for shares of the capital stock of the Philadelphia Electric on the basis of two of the latter for one share of U. G. I. The vote was 1,340,525 shares in favor of the consolidation to 1,250 shares against it.

The consolidation was to come before the Pennsylvania Public Service Commission for its approval on Thursday of this week. The Philadelphia Electric Company will continue to function as a separate organization.

Merger of the Southern Power Company and the Great Falls Power Company (of South Carolina) into the Duke Power Company is reported, following the approval of stockholders at a December meeting. The Duke Power Company owned substantially all the capital stock of the other two, but hitherto it has acted only as a holding company. Henceforth business of the former operating companies will be done in its name.

The Bristol & Plainville Electric Company has been merged with the Connecticut Light & Power Company, consent of the Public Utilities Commission of Connecticut having been accorded contingent on a decrease being made in the Bristol company's capitalization.

The Bedford (Pa.) Light, Heat & Power Company has been acquired by the National Electric Power Company and is now operated by the Penn Central Light & Power Company, connection with that company's system having been completed.

Sales of half a dozen minor independent or municipally owned electric properties have been authorized by the Illinois Commerce Commission. They include sale of the Waynesville electric property to the Illinois Public Utility Company and of the Cisco Electric Company, the Danvers Electric Company, the Stanford Electric Light & Power Company and the Shirley Light & Power Company to the Illinois Power & Light Corporation for $10,000, $54,000, $11,310 and $25,000 respectively.

A committee has been appointed by the Mayor of Shelbyville, Ill., under pressure of business interests, to negotiate for the sale of the municipal electric plant. It is in the territorial district served by the Central Illinois Public Service Corporation, but has previously withstood all overtures from that system.

Sale of the Dlo (Miss.) Light Company to the Mississippi Power Company for $25,000 is reported. The Simpson County Power Company was outbid.

The municipal lighting plant at Woodbury, Ga., has been purchased by the Georgia Power Company, and plans are being made to develop the section industrially.

The Northwest Carolina Utilities Company is reported to have purchased all interests of the Madison Power & Light Company in Madison County, N. C.

Purchase of the light, ice and water plants of Grove, Okla., by the Public Service Company of Oklahoma is announced.

Benton, Ky., has disposed of its light and power plant to the Federal Public Utilities Company, Chicago.

Sale of the Kiowa (Kan.) municipal electric light and power plant to the Western Light & Power Company for $150,000 has been approved by the Kansas Public Service Commission. Authority to sell its municipally owned electric transmission lines and distributing system to the United Power & Light Company is asked of the Kansas commission by the city of Nickerson.

The Nebraska Gas & Electric Company has purchased the municipal electric plant at Sterling, Neb., and will serve it from Adams.

The Iowa Light & Power Company has paid Earlham, Iowa, $15,000 for its municipal equipment and added the town to its circuit.

A certificate has been filed in the office of the Secretary of State of New York merging the Seneca Power Corporation with the Empire Gas & Electric Company.

Springfield, Mass., May Build and Lease Hydro Plant

A hydro-electric plant to cost not exceeding $1,100,000 is included in a program recommended by the Water Department of Springfield, Mass., to the City Council for development of the Cobble Mountain water supply and power system. Plans were explained to the council members on Dec. 5 by E. E. Lochridge, chief engineer. Mayor Fordis C. Parker said that this "may be the greatest development of its kind ever carried out by any city of the East." He indicated his belief that general discussions would precede any vote by the Council on the project. The estimated cost of the entire project is $7,752,000, of which $3,324,184 has been authorized. If the City Council approves, the Legislature will be asked to grant the right to raise the balance.

Engineer Lochridge told the City Council that the Turners Falls Power & Electric Company had offered to pay the city $270,000 yearly for the use of the power plant, with the agreement that the plant should revert to the city at the end of 30 years, all operating expenses to be borne by the company in the meantime. He also said the company stood ready to equip the building with needed electrical machinery at a cost not to exceed $1,100,000, which sum the company would advance and which would not have to be paid by the city until the plant is earning revenue, estimated at three years from undertaking the installation. The plant would include transformers, generators and transmission lines, along with penstocks and necessary buildings.

M. J. Insull Tells of Carrying Power to Texas Towns

During the year 1927 the Insull interests, through the Central and South West Utilities Company and its subsidiaries, will have invested a total of $15,000,000 in Texas, according to Martin J. Insull of Chicago, president of the company, who attended the conference of 200 representatives of the company held recently at Dallas.

"The fifteen million dollars," he said, "spent in west, east and southwest Texas, largely for new generating plants and the improvement of transmission-line facilities, has materially widened the service scope of the electric light and power industry and is contributing substantially to an altering economic condition. It is eliminating a lopsided situation which has long existed in favor of the big cities in that it is furnishing ample power to small cities and towns and permitting them to compete with the big cities of the state for new industries. What these companies are accomplishing in thus stimulating the growth of smaller communities is nothing short of dramatic. This widespread distribution of power is a work of tremendous importance to the economic life of Texas. And not only the small towns but hundreds of farms and ranches are knowing electric service. Further, the last twelve months have seen the greatest progress in the electrification of the oil fields of west Texas that has ever been known in the history of the oil industry anywhere."

Mr. Insull mentioned the new 45,000-hp. generating station at Lake Pauline, near Quanah; the building of a hydro-electric station on the Devil's River near Del Rio, and the construction of transmission lines from the west Texas oil fields to tidewater for the purpose of pumping oil for shipment as among the company's major construction activities of the present time.

Potomac River Rights Are in Contention

South Branch Power Company Extends Application — Eight Permits Sought for Western Streams—Engineering Decisions Awaited

THE South Branch Power Company of Philadelphia has amended its application to the Federal Power Commission for a preliminary permit covering sites on the South Branch of the Potomac and on the Cacapon River so as to include all power sites on the Potomac from tidewater to Harpers Ferry. The extended application is in conflict with the application of the Potomac River Corporation and with one made by Stineman and Quick. Opposition to all Potomac River projects affecting Great Falls is still active on the part of scenery conservationists and others.

H. L. Vorse of Portland, Ore., has applied for a preliminary permit covering a project on the Lake Branch of the West Fork of Hood River. It is planned to install 7,000 hp. at first. The installation is to be increased later to 21,000 hp.

Charles H. Lee and Romaine W. Meyers of Oakland, Calif., are seeking a preliminary permit covering a project on the Illinois and Rogue Rivers in Curry and Josephine Counties, Ore.

J. G. Kelly of Portland, Ore., has applied for a preliminary permit covering a 15,000-hp. project on Marion Lake in Oregon. The same applicant has also asked for a permit covering a 1,300-hp. project on Loon Lake and Mill Creek.

The City of Eugene, Ore., has applied for a preliminary permit covering a project on the McKenzie River in Lane County, Ore.

Other applications for preliminary permits covering small projects have been received as follows: Deschutes Falls Power Company, Deschutes River in Sherman and Wasco Counties, Ore.; Mosquito Power Company, South Fork Mosquito Creek, Park County, Colo.; Wells Power Company, Wells, Nev., Trout Creek, Elko County, Nev.

Some of the engineering studies being made for the Federal Power Commission have been delayed owing to the fact that the Corps of Engineers has had to concentrate on the Mississippi River reports. Among the delayed reports is the one on Wolf Creek for which the commission is said to be waiting before taking action on Cumberland Falls in Kentucky. Another important report being awaited is that on the Kalamazoo River. The applicant is the city of Allegan, Mich.

The Colorado Public Utilities Commission has requested the commission to suspend action on the application of the Public Service Company of Colorado covering a power project on the Arkansas River which involves the diversion of water from the Royal Gorge. The Denver & Rio Grande Railroad has, as already reported, filed a protest against the project on the ground that it will detract from the scenic beauty of the gorge. The Colorado commission, taking a leaf evidently from Tennessee's book, asks also that it be advised when power applications are filed so that the matter of state rights can be threshed out before action is taken by the commission.

Recommendations for Maine Hydro

Pine Tree State's Representative Sets Forth Basis of Power Exportation Favored by New England Utilities in Informal Conference

GOVERNOR BREWSTER of Maine has made public the preliminary report of Franklin Fisher of Lewiston, who represented that state in an informal discussion of the water-power situation at the recent New England Conference at Springfield, Mass. The Governor points out that the executive department has no power to change the state's non-exportation hydro-electric policy and that that responsibility rests with the Legislature. The gist of the Fisher report follows:

It is believed that the conflicting interests may be harmonized and the desired result be fairly and reasonably accomplished if the following principles are observed:

1. That no electricity generated by water power shall be exported beyond the boundaries of a state except under the terms of a written contract between the purchasing and generating companies approved by the regulatory commission of the state where the current is generated, such commission to act only after notice and a public hearing and a finding that, in its opinion, the proposed contract is not detrimental to the interests of present and prospective consumers within the state; that in making this finding due regard shall be given to the developed and undeveloped water-power resources of the generating company.

2. That contracts may be for such term of years, not exceeding a prescribed limit, as the commission may approve, and that during such term the contract may not be terminated except in the manner provided therein or with the consent of the contracting parties.

3. That such contracts may not be amended, extended or renewed without the approval of such commission, and that such approval may be obtained only after notice and public hearing and a finding that, in its opinion, the proposed amendment, extension or renewal is not detrimental to the interests of present and prospective customers within the state, and, in the case of an extension or renewal, a hearing held within a prescribed period before the expiration of the original term.

4. That all rates provided in such contracts shall be subject to change by the joint action of the regulatory commissions of the two states where the electricity is generated and used.

5. That the regulatory commission of the state where the electricity is generated shall continue to have sole jurisdiction over the rates charged for electricity sold and consumed within the state, over the issue of securities and over other activities over which it now has no control.

6. That no generating company or purchasing company shall be required to enter into a contract for the purchase and sale of electricity generated in one state for consumption in another state against its will.

Working to Aid Inductive Co-ordination in Canada

Rapid expansion of the development and distribution of hydro-electric energy in Canada, particularly in the four provinces of Manitoba, Ontario, Quebec and New Brunswick, is creating a new problem for the Dominion Railway Board. While to some extent the trouble has existed for years, it has become more acute recently and may be still more acute in the next decade. Railway companies and telephone companies crossed by high-power transmission lines complain of property damage and dislocation of their telegraphic and telephonic services, and the Railway Board is being called upon to allocate the cause of damage and the liability in a number of cases.

It is expected that the discussion on this issue will be in a somewhat confined sphere, hinging upon a point of law. The railways, it is understood, take the position of the common law on this question, declaring that they and the telephone companies were on the ground first and that the power transmission lines came after and over them, presenting a menace to their services. The transmission companies, on the other hand, are inclined to take shelter behind the French code which requires the establishment of actual negligence before liability can be determined.

Brazil's Abundant Water-Power Resources

Existing hydro-electric developments in Brazil are minor projects in comparison with the future possibilities of this type of development, according to information released by the Bureau of Foreign and Domestic Commerce of the Department of Commerce. "The number of hydro-electric plants is increasing, but the majority of electric power generating units are small and isolated," the report on the electrical development in Brazil states.

The recently completed hydro-electric plant of the Rio de Janeiro Tramway Light & Power Company, on the Parahiba River, has a present operating capacity of 50,000 hp. and an estimated potential capacity of more than 200,000 hp. The electric power generated at this plant is transmitted 60 miles to Rio de Janeiro over an 88,000-volt line. Another large development rapidly nearing completion is that of the São Paulo Tramway, Light & Power Company, which is expected to develop an initial capacity of 29,500 hp. The same company has started construction on a hydro-electric station a short distance from São Paulo, which will develop 80,000 hp. upon its completion. The State of Rio Grande do Sul plans to erect an 80,000-hp. station on the Jacuhy River in order to supply light, heat and power to neighboring towns.

Water power is abundant in the States of Parana, São Paulo, Rio de Janeiro, Minas Geraes and a part of Santa Catharina.

State Park or Power?

Secretary Merrill of the Federal Power Commission Clarifies Present Status of the Widely Advertised Contest Over Cumberland Falls, Ky.

THE reported exercise of the option of the Cumberland Hydro-Electric Power Company, owned by the Insull interests, upon the hydro-electric site at Cumberland Falls, Ky., which has had much newspaper notice, has led O. C. Merrill, executive secretary of the Federal Power Commission, to issue a statement in clarification of the status of that company's application for a license to build a hydro-electric plant there.

If the company does not dispose of the site for park purposes and persists in its application, Mr. Merrill says, "it will be necessary for the commission, when the reports from the War Department have been received, to determine whether the public interest will be better served by the approval of the application for license or by its refusal. The question does not rest wholly on the relative advantages from the public standpoint of power development or park development of Cumberland Falls. It would be possible to develop the power and to retain in large degree the scenic value of Cumberland Falls and the adjacent lands. Furthermore, consideration should be given to the interests of the local communities and to the fact that a development of the magnitude proposed would, by creating taxable wealth, produce revenues in certain Kentucky counties which under existing circumstances find it difficult to secure sufficient means for providing adequate road and school facilities.

"The Cumberland Falls," Mr. Merrill goes on to explain, "are situated at the center of a horseshoe bend in the Cumberland River. The plans of the company propose the erection of an 80-ft. dam about three-fourths of a mile above and out of sight of the falls and the diversion of the waters of the river through a tunnel across the narrowest part of the bend to a power house about one mile below the falls and likewise out of sight of them. No construction work is proposed at or in the immediate vicinity of the falls, but they would be affected by and to the extent that the waters of the river are diverted through the proposed tunnel."

A preliminary permit was issued by the commission to the company on March 4, 1924, there being no objection raised at that time based on injury to scenery and no proposal for a state park. These came later, along with many requests for approval of the project, particularly from organizations and residents in the counties which would be benefited by its construction. Mr. Merrill concludes his statement by saying:

"In addition to the applications of the Cumberland Hydro-Electric Power Company, the Kentucky Hydro-Electric Company, an associated interest, has made application for preliminary permit for a power development on the Cumberland River near Wolf Creek, below Burnside, Ky. It is claimed by the park supporters that the development of this project would make unnecessary the development of the project at Cumberland Falls."

Briefer News

RICHMOND, IND., JOINS THE BRIGHTLY LIGHTED CITIES.—More than forty city blocks will soon be illuminated in Richmond, Ind., by means of an ornamental lighting system, city officials announce. The placing of 240 standards has been completed, and another large area will be equipped. Virtually the entire length of the national road through the city of Richmond now is lighted by the new system.

"MONOPHONE" IS NOW IN PRACTICAL OPERATION.—Major-General George O. Squier has reported, in response to an inquiry from the ELECTRICAL WORLD regarding progress with the "monophone," or wired-wireless, plan, that, in addition to an installation of Kellogg-built equipment on the lines of the Stephenson County Telephone Company in Freeport, Ill., another installation has been placed in successful operation. Robert A. Fox, in co-operation with the Star Telephone Company of Ashland, Ohio, has started a broadcasting service including three programs by means of the monophone plan. Frequencies of 52,000, 125,000 and 175,000 cycles are used for the respective programs. The power required is only 7½ watts, and the service is rendered for a charge of $2.50 a month.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

National Electrical Credit Association—New York Division, Dec. 13. W. J. Kreger, 261 Broadway, New York.

New England Central Station Association of Power Engineers—Chamber of Commerce, Boston, Dec. 15. T. D. Bond, Room 941, 200 Devonshire St., Boston.

American Physical Society—Nashville, Dec. 28-30. H. W. Webb, Columbia University, New York.

American Engineering Council—Washington, D. C., Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington.

Empire State Gas and Electric Association—Electric Section, Niagara Hotel, Niagara Falls, N. Y., Jan. 12 and 13. C. H. B. Chapin, Grand Central Terminal, New York.

National Electrical Manufacturers' Association—Supply Division, Hotel Commodore, New York, Jan. 23-30. S. N. Clarkson, 420 Lexington Ave., New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

American Institute of Electrical Engineers—Winter convention, New York, Feb. 13-16. F. L. Hutchinson, 33 West 39th St., New York.

Seventy-five sets are now connected and receiving the service.

PROGRESS CONTINUES AT ROCHESTER, N. Y.—The Rochester Gas & Electric Corporation power dam at Caneadea will be completed in six weeks or less, provided weather conditions continue favorable, according to Chief Engineer E. R. Crofts. It is expected that the gates of the dam will be closed Feb. 1 and that the reservoir will be filled by May 1. A new 5,000-kw. generator is to be installed in the Lawn Street plant in Rochester, according to an announcement made by Superintendent Thomas H. Yawger, increasing the capacity of that plant to 8,000 kw. It is estimated that nine months will be required to complete this work.

BALTIMORE'S NEW ELECTRIC CLOCK.—A new type of electric clock, which tells the time by red and white flashes from a series of sixteen lamps having a total of 400,000 cp., has been installed on the dome above the entrance to the administration building of the Maryland Casualty Company at Cedar Avenue and Fortieth Street, Baltimore. The apparatus consists of an octagon-shaped copper beacon lantern 10 ft. high, having red and white lamps of 25,000 cp. each. The red lights flash once on the quarter hour, twice on the half, three times on the three-quarters and four times on the hour. After the red lights have stopped flashing the white lights flash the number of the hour. The time, it is claimed, can in favorable weather conditions be told 20 miles away.

PASADENA PUSHES PLANT EXTENSION.—Nearly forty carloads of steam-electric equipment is soon to arrive in Pasadena, Cal., according to Benjamin F. DeLanty, general manager of the municipal plant, from the Allis-Chalmers factory at Milwaukee. The extension to be made will house a 15,000-kw. turbo-generator and two 1,500-hp. boilers to be used with the new unit. The boilers are about twice as high as those now in use, and it has been necessary to raise the roof of the plant 24 ft. The unit will, according to the plans, be ready for use early in 1928. To provide against emergency the city is installing a 25,000-gal. water-storage tank at the plant. Savings approximating $15,000 a year are promised to large consumers of light and power in Pasadena as a result of a new schedule which became effective on Dec. 1.

NORTHWEST INSPECTORS TO MEET AT SEATTLE IN JANUARY.—Plans for the third annual convention of the Northwest Association of Electrical Inspectors, to be held in Seattle, at the Olympic Hotel, Jan. 26-28, are rapidly taking shape. Among those who will address it are Dana Pierce, president Underwriters' Laboratories, Chicago; H. B. Kirkland, secretary Society for Electrical Development, New York; W. A. Groce, state fire marshal, Olympia, Wash.; L. W. Going, chief electrical inspector, and J. C. Caine, deputy electri-

cal inspector, Portland; G. K. Comstock of the American Products Corporation, William Meacham of Meacham & Babcock, contractors and engineers, and R. A. Laing, fire marshal, Seattle. The custom begun last year of having a manufacturers' exhibit of equipment will be continued.

EMERGENCY FLOOD CONSTRUCTION WORK UNDER WAY IN VERMONT.—Emergency flood construction work for the Vermont Hydro-Electric Company at Glen, Carvers Falls, and Mendon, Vt., and for the Twin State Gas & Electric Company at Bennington, Vt., and Hoosick Falls, N. Y., will be started immediately by the Morton C. Tuttle Company, Boston, that company announces.

JACKSONVILLE (FLA.) MUNICIPAL PLANT TO BE DOUBLED IN CAPACITY.—Jacksonville (Fla.) authorities have adopted a program of expansion for the municipal light and power plant involving $2,000,000 and intended to provide for an anticipated population of 300,000. A new 30,000-kw. turbo-generator, now under manufacture by the General Electric Company, together with boilers and auxiliary equipment, will cost $1,250,000. The present equipment includes one 12,500-kw., one 10,000-kw., one 4,000-kw. and two 1,500-kw. generators. When the new unit is ready most of these machines will be used as reserve equipment only. Another major item in the program is a new office and substation building to cost $250,000. The steel structure to house the additional equipment is well under way.

NEBRASKA COMPANY TO DEPEND ON ENERGY FROM GOVERNMENT DAM.—The Western Public Service Company of Scottsbluff, Neb., has contracted with the government Reclamation Service to purchase all of its electrical energy requirements from the Guernsey (Wyo.) Dam power plant. A. S. J. Steele, district superintendent, says that the contract figure is practically the cost of generating energy in the Scottsbluff plant, but that the new deal will permit of a much more rapid development of its service plans, which include a wide extension of rural and pumping service. The company advanced $75,000 to the Reclamation Service to finance the construction of the necessary transmission line from Lingle, Wyo., to a point 8 miles from Scottsbluff. It will entirely reconstruct its substations at Minatare, Bayard, Bridgeport, Broadwater, Dalton and Gurley.

ENGINEERS DISPUTE OVER ECONOMY OF PROPOSED EXPENDITURE ON HUNTINGTON (IND.) CITY PLANT.—The city of Huntington, Ind., can purchase electricity from the Northern Indiana Power Company much more cheaply than it can be manufactured at the city plant if $60,000 should be spent for additional equipment, according to the report of H. O. Garman, an Indianapolis consulting engineer who was retained by remonstrants against the city bond issue for the improvement of the municipal plant. Electricity produced at the plant will cost $0.0199 a kilowatt-hour at the switchboard, according to the report, while it can be purchased from the Northern Indiana Power Company for $0.0125 a kilowatt-hour. City engineers, however, assert that electricity could be produced at from $0.0102 to $0.0104 a kilowatt-hour. The evidence on both sides will be presented to the state Board of Tax Commissioners for decision on whether the city bond issue of $60,000 shall be permitted.

EDISON IN THE "TALKING MOVIES."—On Edison night, Oct. 21 last, when a dialogue between E. W. Rice, Jr., honorary chairman of the General Electric Company board, as interviewer, and Thomas A. Edison was broadcast over a wide territory, a talking motion picture was also taken. A small piece of the film is shown here, with the marginal record of the voice vibrations. Mr. Rice is sitting at Mr. Edison's right. The others present are Mrs. Edison, George

F. Morrison, former president of the Edison Pioneers, on the extreme left, John W. Lieb, vice-president New York Edison Company, on Edison's left, and Gerard Swope, president General Electric Company.

FINNISH PARLIAMENT VOTES ELECTRICALLY.—The Finnish Parliament has now an electric vote-recording apparatus similar to that which was one of the first of Edison's inventions but to this day has not been installed at Washington and probably not elsewhere. Every member has on his desk two buttons, signifying "yes" and "no," and a vote can be taken and automatically counted in a minute, the result appearing on a board back of the president. The speeches made in the Finnish chamber are broadcast by radio, so that the whole population can "listen in." With these innovations the Finns claim to have the most modern legislative proceedings in Europe.

NEW YORK STATE GAS & ELECTRIC ADOPTS TWO-PART RATE.—A new schedule of rates both for residential and commercial service has been filed by the New York State Gas & Electric Company with the Public Service Commission, to become effective Dec. 25, and a scheduled rate hearing has been postponed. The new rates are of the two-part type, with a fixed charge and an energy charge. The residential rate is to be made up of a fixed charge of 75 cents plus 10 cents per 100 sq.ft. of floor space and an energy charge of 4 cents a kilowatt-hour. The commercial rate includes a fixed charge of 75 cents plus 50 cents per 100 watts of demand and an energy charge of 4 cents a kilowatt-hour. The new rates are to be optional with the consumer. It is thought that at least one-third of the users will benefit by them. They take the place of a 14-cent charge.

SAULT STE. MARIE, ONTARIO, RECEIVES OFFER OF MORE POWER.—The Great Lakes Power Company has made a proposal to the city of Sault Ste. Marie, Ontario, to supply it with 1,000 hp., additional to the 4,000 hp. now supplied, within three months at $20 per horsepower, and a further block of 5,000 hp. in units of not less than 1,000 hp. each, within fifteen months of demand therefor, at a rate not in excess of $22 per horsepower. The proposal will probably be submitted to the ratepayers. As previously noted, the city has been clamoring for more power, carrying its plea to the Ontario Hydro-Electric Power Commission. The Great Lakes Power Company is managed by the Middle West Utilities Company.

NEW COMPANY TO DEVELOP MANITOBA WATER POWER.—An agreement entered into between the Whitney interests of New York, who are taking over the Flin Flon copper deposits of northern Manitoba, which they have been operating under option, and the Candian government provides for the opening up of the area by a railway, the construction of a smelter and the development of electric power on an extensive scale. A new company is to be formed to develop White Mud Falls on the Nelson River and Island Falls on the Churchill. This company must sell power not only to the Flin Flon but to other mines at a rate fixed by the Manitoba Public Utilities Commission. The power leases are to be for 50 years, but may at any time be taken over by the Manitoba government at a price fixed by arbitration. The possible power development at these two points is about 400,000 hp. The company will be formed from those interested in the Flin Flon and Gordon Sherritt properties.

POTOMAC ELECTRIC POWER COMPANY AGAIN REDUCES RATES.—Another substantial reduction in electric rates will be put into effect on Jan. 1 by the Potomac Electric Power Company of Washington, D. C., under a schedule just approved by the Public Utilities Commission of the District. The new rates will, it is estimated, bring a saving to electric consumers next year of $337,895. The residential rate, which affects 93,546 consumers, provides for a cut from 6¼ to 5.9 cents a kilowatt-hour. This reduction will mean a saving of

$133,716. Similar reductions are to be made in virtually all the other schedules. The lower rates are the result of a profit-sharing arrangement which the commission has had with the power company since 1924, whereby one-half of the excess earned by the company over a return of 7½ per cent is returned to the consumers the following year through a cut in electric rates. When the agreement was first put into effect the electric rates were 10 cents a kilowatt-hour.

TEXAS UTILITIES COMPANY TO CUT RATES ON FAST-GROWING SYSTEM.—At a banquet given at Plainview, Tex., by the Texas Utilities Company, attended by more than 200 representatives of the 35 towns of northwest Texas served by the company, announcement was made that substantial reductions of the rates for power and light would be made on Jan. 1. I. R. Kelso of St. Louis, president of the company, in reviewing its activities from the time it purchased a plant at Plainview in 1915, announced that with the completion of a high-tension line connecting Happy and Kress, which will be placed in operation at the first of the year, the company will have four interconnected central power plants—at Lubbock, Plainview and Canyon, Tex., and Clovis, N. M., respectively—each capable of supplying the various towns, and a system of transmission lines so constructed that any of the central-station plants can feed two or more circuits to the same town. The company's territory has increased tenfold in population in the last twelve years.

ALUMINUM COMPANY BALKS AT TENNESSEE'S HYDRO TAX.—If the Tennessee Railroad and Public Utilities Commission attempts to enforce its recent order demanding a tax of 1 mill on each kilowatt-hour of power generated against the Aluminum Company of America, that corporation, newspapers in the state say, probably will abandon its projected 50,000-hp. dam on the Little Tennessee River at Calderwood and may curtail its other power development plans. The tax would, it is said, be regarded by officials of the company as prohibitive and the company will fight the order, if the commission attempts to enforce it. The Aluminum Company of America has three completed or projected plants on the Cheoah and Little Tennessee Rivers, the total capacity of which was to be 250,000 hp. and the total cost $30,000,000. One plant, at Cheoah, in North Carolina just across the Tennessee line, already is in operation. Its capacity is 96,000 hp. The second project at Santeetlah, on the Tennessee-North Carolina line, will be completed in January. Its capacity is 110,000 hp. and it is on the Little Tennessee River. The third unit, which the company threatens to abandon, is on the Little Tennessee River below the junction with the Cheoah, at Calderwood.

Commission Rulings

INCREASED RATES TO EXTRA-MUNICIPAL CONSUMERS ARE AUTHORIZED.—The Wisconsin Railroad Commission has authorized the Oconomowoc water and electric departments to increase their rates to consumers beyond the city limits, saying that a municipal utility supplying local consumers substantially at cost is under no obligation to serve out-of-city consumers on the same basis.

MUNICIPAL PLANT PURCHASING ITS POWER SHOULD DESIGN RATE SCHEDULES TO ENCOURAGE USE.—The Wisconsin Railroad Commission in fixing a rate schedule for the municipal authorities of Cuba City to enforce in the resale of purchased power insisted that the rates be drawn so as to encourage the use of energy. The municipality was required to care for its six small power users, who had motors of 1 hp. to 5 hp. rating, by the application of the regular lighting rates, but the customers were to have the option of retaining a separate meter. The municipality was also required to differentiate between residential and commercial lighting service rather than between commercial lighting and commercial power.

INDUCTIVE CO-ORDINATION A MATTER FOR EXPERTS.—The Nebraska State Railway Commission has adopted the practice of calling to its aid in certain disputes the joint committee on inductive co-ordination maintained by the Nebraska Section of the National Electric Light Association and the Nebraska Telephone Association. When transmission-line companies and telephone companies appeal for adjudication of disputes arising because the transmission companies want to occupy highways on which there are grounded rural telephone lines, as in a recent case involving the Central States Electric Company and the Northeastern Telephone Company and affecting lines between Walthill and Macy, the commission holds that such disputes involve technical matters and tests with which only experts are familiar. The findings of an impartial committee like the one maintained in Nebraska should, it is contended, have the same weight as that which courts give the findings of referees selected for similar reasons.

NORTH DAKOTA COMMISSION FORCES COMPROMISE IN DISPUTE OVER INDUCTIVE INTERFERENCE.—Failure of the Otter Tail Power Company of Fergus Falls, Minn., and the Sheyenne (N. D.) Telephone Company to agree on a settlement of their differences regarding the cost of correcting inductive interference with telephone lines by nearby power lines has resulted in a decision by North Dakota Board of Railroad Commissioners which splits the difference between the two public utilities. The case resulted from construction by the power company of a power line which paralleled a telephone line already in use. The telephone company agreed to the location of the power line, and the power company in its turn agreed to correct any interference which might develop on the telephone line by making the latter "metallic" or moving it. When the power line was built and energized, however, the two companies failed to agree on the method of removing the interference, which immediately developed to such an extent that the telephone line was almost useless. The power company wanted to install mechanical devices to correct the situation. The telephone company wanted the power company to build a new telephone line. Finally the telephone company built its own line and attempted to charge the cost to the power company. A special committee appointed by the telephone and power interests to adjust all such disputes worked on the case but failed to bring about a settlement, and it was presented to the commission, which awarded the telephone company a sum midway between the amount it claimed and the amount offered in settlement by the power company. In most cases, board members said, the possibility of power lines setting up inductive interference with telephone wires is eliminated by the commission's rule which requires that its engineers approve the route and specifications of all new public utility construction.

Recent Court Decisions

CONTRACT BETWEEN VILLAGE COUNCIL AND ITS OWN MEMBERS AS INDIVIDUALS DECLARED INVALID.—The Minnesota Supreme Court has ruled that a village council cannot build an electric plant and then turn it over to its members. The court has upheld an order setting aside the contract between the members of the Courtney Village Council and themselves as officials of the electric company. In 1920 the village built an electric plant, costing $3,773, of which the village paid $3,000 and the Council members the remainder. Then the Councilmen executed a contract with themselves whereby they assumed charge of the plant. A new council brought suit to recover the $3,000. The lower court held that while the transaction was made in good faith, the contract was void under the law. The Supreme Court upheld this decision and awarded the $3,000 to the village. Two members of the council which brought the suit were members of the 1920 council.

NORTHERN NEW YORK UTILITIES LOSES SUIT AGAINST WATERTOWN.—The Appellate Division of the New York State Supreme Court has confirmed a decision dismissing the complaint of the Northern New York Utilities against the city of Watertown. The action resulted from the refusal of the city to purchase equipment, valued at $192,256, owned by the company when the city decided to install a municipal lighting plant. The complaint, the court says, did not state facts to constitute sufficient cause for action. By a contract made between the city and the company in May, 1915, it was agreed that the city would purchase all poles, conduits and other equipment installed by the corporation if the city ever decided to install a municipal plant. This contract ran for five years. Another contract was drawn in January, 1921, running three years, and it provided that if the city gave notice of its intention to install a municipal plant during that time, it could do so, but it provided a different method from that of the 1915 contract for determining the value of the equipment owned by the company and to be purchased on option by the city. It was not until April 8, 1925, that the city notified the company that it intended to establish a municipal lighting system. The company then sought to have the city pay the sum claimed.

News About Men of the Industry

C. G. Adsit Resigns from Georgia Power Company

Charles G. Adsit, vice-president and consulting engineer of the Georgia Power Company, Atlanta, has resigned to engage in private consulting engineering work with offices in Atlanta. Mr. Adsit has been closely identified with every big engineering task under-

C. G. ADSIT

taken by the company and its predecessor, the Georgia Railway & Power Company, since he became resident engineer on the Tallulah Falls hydroelectric development in 1911. Later he was made consulting engineer and chief engineer and in this capacity had charge of such developments as the Mathis dam and reservoir, the Burton dam and reservoir and the Tugalo development. The caliber of the work accomplished under Mr. Adsit's directions won prompt recognition, and it was not long before he was made executive engineer with authority and jurisdiction over all engineering work of all the departments of the company. It was in May, 1923, that the board of directors elected him to the position of vice-president. Before going to Atlanta Mr. Adsit had extensive engineering experience in the western part of the United States, in South America and Mexico.

S. J. REED is the new manager of the Otter Tail Power Company at Velva, N. D.

J. M. FLANIGEN, distribution superintendent of the Alliance division of the Ohio Public Service Company, has resigned to assume similar duties with the Georgia Power Company at Rome, Ga. Mr. Flanigen first started to work for the Doherty organization at Athens, Ga., in 1913. Later he entered the Georgia Institute of Technology and was graduated in 1917, having worked during his summer vacations for the Athens company. Upon returning from military service in 1919 he entered the Doherty Training School at Toledo and was successively transferred to Danbury, Cumberland, Massillon, Alliance, Warren and finally back to Alliance as superintendent of distribution in 1925.

SAMUEL J. FARIS has recently affiliated himself with the New England Power Company, Worcester, Mass. Mr. Faris has had varied experience both in operating and in electrical construction work with the Southern Power Company, the Georgia Railway & Power Company and other power companies in the South.

F. L. CARLISLE is chairman of the board of directors of the New England Power Association instead of A. R. Graustein, as stated in the ELECTRICAL WORLD of Dec. 3. Mr. Graustein is chairman of the executive committee of the board of directors.

C. W. Amidon President of Nebraska Company

Charles W. Amidon, who has been vice-president and general manager of the Central Power Company, Grand Island, Neb., for the past year and one-half, has been elected president of that utility. Previous to transferring his interests to Nebraska in 1926, Mr. Amidon spent twelve years with the Central Illinois Public Service Company.

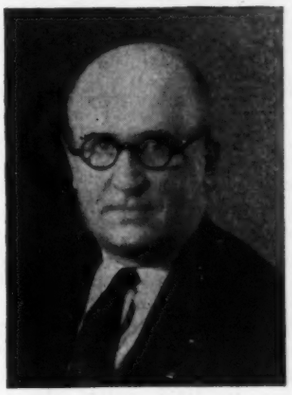
Affiliating himself with the Illinois utility in 1912 as superintendent, he was appointed three years later as division engineer. Mr. Amidon's progress was somewhat retarded when he relinquished his duties to enter military service, but following his discharge after two years' service he again affiliated himself with the Central Illinois

C. W. AMIDON

Public Service Company. It was not long before he was promoted from the position of chief clerk of one division to be a division manager. This position he left to become vice-president and general manager of the Central Power Company.

H. A. Neil Made General Manager of Georgia Utility

H. A. Neil, formerly general superintendent of the several Georgia and West Florida properties operated under the direction of the General Engineering & Management Corporation of New York, has been appointed general manager of the Georgia Power & Light



H. A. NEIL

Company, Valdosta, Ga. Mr. Neil's connection with the public utility industry dates back to 1907, when he entered the construction and operating departments of the Albion Power Company at Albion, N. Y. He remained with this company until 1910. In addition to his connection with the construction and operating departments he was directly associated with the commercial department.

Mr. Neil left this organization to join the operating and construction department of the Niagara, Lockport & Ontario Power Company at Buffalo, N. Y., but in 1925 removed to the South to become manager of the Ware County Light & Power Company, serving Waycross and adjacent cities in Georgia. In this position Mr. Neil continued until early in 1927, when he was made general superintendent of the Georgia and Florida properties of the General Engineering & Management Corporation referred to above.

During his period of service as manager of the Waycross company Mr. Neil very substantially increased the business of that company and was responsible for the electrification of many isolated plants and the extension of numerous transmission lines to several communities in south Georgia.

E. RYAN, formerly commercial manager of the Fort Smith Light & Traction Company, has been appointed manager of the Oklahoma Gas & Electric Company at Poteau to succeed L. A. Wiedman, who is now at Norman. Mr. Ryan first joined the Fort Smith Light & Traction Company in 1913 as engi-

neer in the railway department. A year later he became identified with the Interstate Commerce Commission in the valuation department, remaining in that position until 1918. The year 1919 found him with the Chicago, Milwaukee & St. Paul Railroad in the electrical and valuation department, but in 1920 he returned to the Fort Smith Light & Traction Company in charge of the engineering section.

H. C. HOPKINS is the new manager of the Armour (S. D.) division of the Northwestern Public Service Company.

WILLIAM STANNARD, formerly illuminating engineer in the Battle Creek district of the Consumers Power Company, has been transferred to the Grand Rapids district. Mr. Stannard is succeeding Mr. Donovan as lighting engineer.

J. S. DALES has been elected vice-president of the Public Utilities Consolidated Corporation, the utility holding company for the W. B. Foshay Company. Mr. Dales is returning to the United States after ten years of service in the management of public utilities in Latin America. He first entered the public utility industry in 1903 in Lincoln, Neb., his home city, with the Lincoln Gas & Electric Company, but in 1907 joined the Child Hulswit Company of Grand Rapids, Mich., as operating and construction engineer. Subsequently Mr. Dales spent four years as general manager of properties in South Dakota, Iowa and Indiana, at the termination of this period affiliating himself with the Insull interests in Indiana. It was in 1916 that he joined the Electric Bond & Share Company, serving in Panama and later in Cuba. In his new work Mr. Dales will assist in the management and operation of utility properties and in the investigation of new properties under consideration by the Foshay company.

JAMES C. BENNETT, comptroller and secretary of the Westinghouse Electric & Manufacturing Company, was elected a vice-president of that organization at a meeting of the board of directors held Nov. 30. In his new position he will have general charge of the accounting and treasury departments. In length of service Mr. Bennett is the oldest employee in the Westinghouse Electric group, having been employed by the Westinghouse Electric Company in 1886—five months after that company was formed. His first position was assistant to the auditor, and in 1898, after working continuously in the accounting and treasury departments, he was elected auditor. Subsequently he made several trips to Europe to inaugurate and supervise the accounting systems of the foreign Westinghouse companies. In 1909 the office of comptroller was created, and in this position Mr. Bennett was placed in charge of the accounting systems of the parent and subsidiary companies. In 1911 his headquarters were transferred to New York City, at which time he was also made secretary of the company. Mr. Bennett is a director of the Westinghouse Electric & Manufacturing Company and also an officer and director of a number of its subsidiary companies.

E. C. Deal New Head of People's Light

E. C. Deal, who has been elected president of the People's Light & Power Corporation, as recently announced in the ELECTRICAL WORLD, brings to his new executive position an exceptionally wide experience in the public utility field. His engineering activities, covering a period of more than twenty years, have taken him into various sections of the United States and Latin America in executive capacities.

A native of Georgia, Mr. Deal received his first experience with the Georgia Electric Light Company of Atlanta in the early nineties. He then was connected in various capacities

E. C. DEAL

with Stone & Webster in Baltimore, Seattle, Brockton and Terre Haute and later became superintendent of the electrical properties of the Public Service Corporation of New Jersey in central New Jersey. Later he assumed executive duties with the J. G. White organization, the W. N. Coler interests of New York and the Federal Light & Traction Company. More recently he has been identified with the Electric Bond & Share Company in Cuba and, just prior to joining People's Light, with the General Engineering & Management Corporation. Mr. Deal has been prominent in association work, having been president of the Southeastern Division of the National Electric Light Association, president of the Georgia Public Utilities Association, a vice-president of the National Electric Light Association and a vice-president of the Missouri Public Utilities Association.

M. RAY VEAL, commercial manager of the Carolina Power & Light Company, Asheville, N. C., has resigned to enter the electrical business for himself in Atlanta. Mr. Veal will be succeeded by C. T. Izler of Florence, S. C., who was local manager of the Carolina Power & Light Company. The retiring manager had been in Asheville two years and was in the Raleigh office five years.

AVERY W. BRIGGS, who has been superintendent for the Southern Sierras Power Company at Calexico, Cal., for the past seven and a half years, has been transferred to Corona, Cal., as superintendent.

Obituary

ALONZO G. KINYON, consulting engineer with the Fuller Lehigh Company, Fullerton, Pa., died Nov 13 in Baltimore. Early in his career Mr. Kinyon became interested in the development of fuel-burning equipment and fuel conservation, and it was in 1918 that he became associated with the Fuller Lehigh organization. His greatest contribution to industry was the invention and development of the Fuller-Kinyon Conveying System for transporting pulverized material. In recognition of his efforts he was awarded last year the Longstreth medal by the Franklin Institute as well as life membership in that organization.

CARL EICKEMEYER, engineer and inventor, died at his home in Brooklyn, N. Y., Dec. 1. Mr. Eickemeyer's father was an inventor of some note, and the son received excellent training as his father's assistant. Thus being launched upon a successful career, he later established the Eickemeyer-Field Manufacturing Company, which subsequently was merged with the General Electric Company. As a consulting engineer his advice was sought on various engineering problems in different sections of the country. Mr. Eickemeyer had patented many inventions in the mechanical field, including automatic electric pumps, a high-speed third-rail and other devices. He traveled extensively and was interested especially in the Indians of the Southwest. He presented to the American Museum of Natural History a collection of historic relics which he brought back from that region, and he recorded the results of his research work in several books descriptive of Indian life there. Mr. Eickemeyer was 58 years of age.

JESSE SCRIBNER of the Chicago office of the General Electric Company died Nov. 26 after a brief illness. Mr. Scribner was one of the oldest employees of the company, having entered its service in 1889. Prior to his employment by the Thomson-Houston Electric Company, Mr. Scribner was a telegraph operator. His service with the company included a position as manager of the lighting department for a number of years and special assignments more recently.

Financial and Statistical News

Utility Markets Irregular Bond Prices Unchanged Few Light and Power Defaults

DURING the last week the stock market moved as a whole within a narrow range with trading relatively light in volume. There existed much irregularity and uncertainty, and the utilities were no exception to the general rule. Brooklyn Edison lost five points, Columbia Gas & Electric lost one point and Commonwealth Edison two, while Detroit Edison gained one, Edison Electric Illuminating of Boston eight and Middle West Utilities four. On the curb among the losers were American Gas & Electric, Northeastern Power and Southeastern Power & Light and several other issues. The index of fifteen representative stocks compiled by the ELECTRICAL WORLD showed a loss of one point, while the preferred issues remained unchanged. In the bond market easy money kept the issues strong.

The publication last week of a list of defaults among the bonds of public utility companies during the year is most significant from the standpoint of power and light companies. Out of a considerable list only one name is that of a power and light company, and the company involved is more interested in traction than in power production. This adds to the absurdity of the hesitancy which exists on the part of legislatures in making these issues eligible for savings-bank and trust investment. Default in the case of the typical power and light company bond, under present conditions or under conditions anticipated in the future, is a possibility that can be virtually eliminated.

Bonds Called in December

Among the securities of electric light and power companies called for payment in advance of maturity are the following:

Issue	Due	Amount
Alabama Power, 6s	1951	$21,000,000
Philadelphia Electric, 6s	1941	11,921,800
Pacific Gas & Electric, 7s	1940	10,730,000
Penn Central Light & Power, 6s	1953	10,300,000
Penn Central Light & Power, 5½s	1964	2,053,000
Philadelphia Suburban Gas & Electric, 6s	1943	6,155,500
Shawinigan Water & Power, 5½s	1950	6,000,000
Columbus Railway, Power & Lt., 6s	1941	5,903,000
Metropolitan Power, 6s	1953	3,250,000
Ottawa-Montreal Power, 6½s	1949	1,500,000
Louisville Gas & Electric, 6s*	1937	82,100
Ohio State Power, 6s*	1935	56,000
Indiana Hydro-Electric Pwr., 7s*	1951	29,000
Catawba Power, 6s*	1933	25,000
Oberpfals Electric Power, 7s*	1946	16,000

* Not entire issues.

British Electrical Industry's Capital Placed at £810,824,179

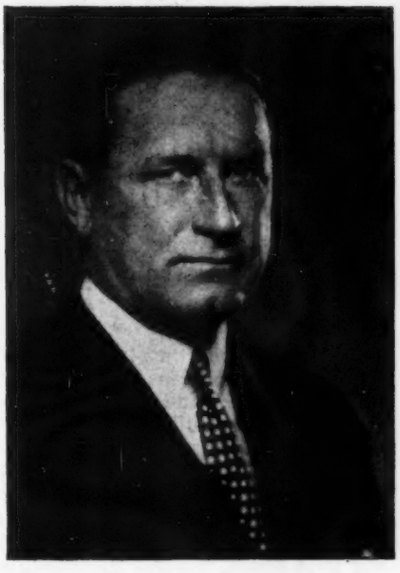
Capital invested in the British electrical industry has increased during the past year by more than £43,500,000, bringing capital invested to £810,824,179, subscribed in 1,633 undertakings in all branches of the industry, according to a report made public by the Department of Commerce. The figure includes loans authorized for municipal undertakings. The year's increase is distributed over the various branches of the industry as follows: Electricity supply, £31,500,000; electric traction, £500,000; telephones and telegraphs, £11,000,000 and manufacturing and miscellaneous, £500,000.

The technical statistics of the industry disclose the capacity of generating plant installed in 745 generating stations to be 5,127,500 kw.-hr.; the number of consumers to be 2,043,000, with a total connected load of 7,480,000 kw.-hr.; kilowatt-hours of electricity consumed amounted to 6,444,116,000.

Sloan Warns Against Socialization of Private Business

Brooklyn Edison President Tells Insurance Company Heads of a Half Century's Progress and Outlines Dangers Inherent in Government Invasion

THAT more than a billion dollars of life insurance company funds is invested in utility securities was one of the opening statements made by M. S. Sloan, president of the Brooklyn Edison Company, in addressing the Association of



M. S. SLOAN

Life Insurance Presidents this week. Pointing out the stupendous changes wrought in the life and work of the nation through the development of electrical energy, Mr. Sloan stressed the significance of the confidence placed by the large fiduciary institutions in investing their funds in ever larger volume in utility securities. After most rigid and critical analysis, their experts deem these issues among the most suitable and attractive for the purpose.

Discussing the progress that has been made in the power industry since its inception, Mr. Sloan said in part:

"There is only one justification for a continuing enterprise—is it doing a good job now, so handled that it will be a better job tomorrow? Less than half a century old, the power and light industry has become great and successful because it is a key industry on which a large proportion of all other business depends. . . . In the United States is used nearly as much electricity as in all the rest of the world. Engineers, public officials, commissions from other countries visit us, study our methods and the results obtained, and when they take their reports back home they are sometimes greeted with incredulity.

"There is not a community of five thousand population in our country which lacks electric service. There are many villages much smaller which have it, even down to crossroad hamlets of one hundred or fifty people. There are 350,000 farms in the country with central-station service, and the number is very rapidly increasing."

BENEFITS THROUGH GROUP OPERATION

Through plant and system interconnections and group operation, the speaker pointed out, there has been made possible "a maximum and most economical use of capital invested and a maximum use of the lowest-cost power sources. It makes possible provision of the best service at the lowest cost which the ability and the resources of the industry can compass at this time." He continued:

"Improvements in the technique and economies in the administration of the companies have been reflected in reductions in rates. These lower rates have stimulated use of service which has made possible lower unit costs of production and distribution, reflected in due course in a further lowering of rates or improvement of service or both. The average price of electricity for domestic use is 15 per cent less now than it was in 1913, while the average price of all electricity sold in the country is just what it was then, which means that, considering the change in the dollar's value, it is considerably lower."

Turning to the social progress made

possible through electrical development, the speaker said:

"Every kilowatt-hour of the billions produced by this industry when put to work means betterment of human conditions. If our grandmothers could return and see how the work of the modern home is lightened and brightened by electricity, they would think that the dawn of the millennium had arrived. Electricity does the hard work, the heavy work, the dirty work in mines and mills and factories. It does such work quicker, better, less expensively than human muscle could, and the workers do their jobs in safer and more sanitary conditions. The American worker has ceased to be a one-man machine. He is, in effect, the foreman or gang boss of thirty or forty workers through the electrical power at his disposal. His productive power has been enhanced so that his employer is able and glad to pay him wages correspondingly enhanced—the highest wages in the world.

"All that electricity has done for the city home and for the factory it is coming to do for the farm and the farm home. Their problems are being studied scientifically by representatives of power companies, farmers' associations and state colleges of agriculture. As electricity has taken the back-breaking drudgery out of factory work and greatly increased factory production at lowered unit cost, so it is taking the toil—the muscle work—out of farming and reducing the cost of crop production. That is one of the remaining frontiers which electricity is breaking down, and I don't think of any one piece of work ahead of our industry which is more important in its social and economic implications. My personal belief is that farm electrification will contribute as much to the farm relief as collective marketing or any scheme of government aid which could possibly be adopted—perhaps a great deal more.

"In the next few years the electrical industry will be called on to participate in railroad electrification on a large scale. Experience with railroad mileage already electrified and engineering studies carried on by railroads and by power companies indicate the possibility of such striking economic advantages that the change-over in motive power is inevitable, notwithstanding the size and complexity of the problems involved.

Built by Private Initiative

"This power and light industry is a man-made institution. As such it is, of course, not perfect. It has made mistakes, but we who are charged with the responsibility of handling its affairs believe that where discovered they have been corrected and that, on the whole, a good job has been done of which we can be properly proud. That opinion is not unanimous in our country. There are those who would have the pioneer spirit abandoned—that American spirit of individual initiative and enterprise which has been responsible for the inception of the industry, its development, its accomplishments. They would have government in the power business—piecemeal at first, completely in the end. They maintain that government—state or federal, or both in combination—could do a better job than has been done by those responsible for what we have today.

"We of this industry don't believe that, gentlemen. We don't want government to go into the power business at Muscle Shoals or at Boulder Dam, on the Columbia or the St. Lawrence or any other place, because we don't believe it could do as good a job as could be done by private initiative and private capital. We don't believe that government competition with private initiative in the power business can be productive of good either for the government or the public. Our government was not built to enter into business. And if government were eventually to take over the power business, I can imagine nothing more detrimental to the welfare of our country and its people than this substitution of political control and bureaucratic inertia for the spirit which has made this industry what it is. On that spirit, I maintain, our country must rely for future progress and development in the electrical field.

"It has been said that the power and light industry is afraid of losing business where government would compete and still more afraid of having its octopus grip on the public broken. The industry could survive any such loss of business and still grow and prosper. If it couldn't meet any rates the government could sell power for, on accurate computation of costs, it ought to go out of business.

"Our industry is not apprehensive on either count. What it objects to is any beginning of socialization of this business, publicly owned, officially regulated by the public's own representatives, which under American pioneer spirit has constructed a record of measurable public service and is able to keep on going and better that record.

"No other problem of the future bothers us of the industry. We don't believe that we are overconfident in our attitude toward the years ahead. Our industry is old enough to have experience, young enough for our energy and enterprise still to be vigorous. We have pride in our work, personal joy in our tasks, a sense of public duty in our approach to them. This problem of government invasion of the power field is our problem, to be sure, but not ours alone. It is yours, since your companies are owners of light and power company securities. It is the general public's, since it is public money which must be taken to put government into this business. It is still more the public's since the question whether government shall enter business—any business, anywhere—involves a fundamental departure from American principles."

Refunding of High Interest Issues Saves Millions in Fixed Charges

Alabama Power Company Replaces Twenty-one-Million-Dollar Issue of 6 Per Cent Bonds by Flotation Paying 4½ Per Cent

TYPICAL of the large-scale refunding operations so prominent in this year's power and light financing is the recent forty-million-dollar issue of 4½ per cent mortgage bonds sold by the Alabama Power Company. Of this total, $21,000,000 is to be used for actual refunding purposes, to retire all of the first mortgage lien and refunding gold bonds, 6 per cent series, due 1951. The balance is for the purchase of additional plant and equipment, for extension of service and "for other corporate purposes."

While this issue by no means creates a precedent in 4½ per cent financing, it is probably the first issue at this rate sold by a company operating outside a metropolitan area. Some of the companies which financed at a 4½ per cent interest rate this year are Commonwealth Edison, Duquesne Light, Kansas City Power & Light, Philadelphia Suburban Counties Gas & Electric Company, Columbus Railway, Power & Light Company, Pacific Gas & Electric Company, Philadelphia Electric and New York Power & Light.

The issue to be refunded was sold in 1921, when rates were at a very high level. It was made callable at 105 up to 1932 and would normally have matured in 1951. Disregarding its sale price, callable price and the sale price of the refunding issue, which was 94¾ and interest, it is evident that the saving to the company is some $315,000 per year, or more than $7,000,000 during the period to the issue's normal maturity date. Such figures, which can only be used as a rough estimate, indicate the saving to the power and light industry as a whole, of this year's refunding operations. Figures not yet completed for the year indicate that refunding will account for more than one-third of the total volume of public financing, making possible an annual interest saving to the industry as a whole of more than $6,000,000.

Fulton (N. Y.) Utility Increases Capital.—The Fulton Light, Heat & Power Company has filed notice of an increase in the numbers of its shares of capital stock from 19,500 to 21,000, of which 18,000 will be common without par value and 3,000 will be preferred stock, $100 par value. Formerly the 19,500 shares of stock were divided into 3,000 shares of common

stock, $10 par value; 15,000 shares class A stock preferred, $10 par value, and 1,500 shares of class B stock preferred, $100 par value.

BUFFALO, NIAGARA & EASTERN POWER STOCKHOLDERS TO SUBSCRIBE TO ADDITIONAL STOCK.—Stockholders of the Buffalo, Niagara & Eastern Power Corporation of record Nov. 30 have received the right to subscribe on or before Jan. 3 for 525,000 shares of class A stock at $20 per share, on the basis of one share of class A stock for each four shares of common stock held.

STANDARD GAS & ELECTRIC ISSUES RIGHTS.—Holders of common stock of the Standard Gas & Electric Company have been offered the privilege of subscribing on or before Dec. 28, 1927, to additional common stock at $50 a share to the extent of one-tenth of their record holdings as of Dec. 6. For this purpose the board of directors of the company has authorized an increase of 10 per cent in the outstanding common stock, proceeds of which will be used for additional investment in public utility companies.

Widening of Legal Investment List More Imperative Than Ever

WHILE efforts to have legislation introduced to widen the list of legal investments for savings banks and fiduciary institutions have continued unabated, 1927 draws to a close with little progress actually made. In general the same absurd situation still exists—a rapid annual increase in investable funds by these institutions and an actual decline in the volume of securities available. As pointed out by one of the speakers before the joint legislative commission investigating the need of broadening the field of investment for savings banks and trust funds, "the savings banks of New York State have been endeavoring for years to have enlarged the list of investments legal for savings banks. During the same period trustees, and especially corporate trustees, have been seconding the application of the savings banks, so to speak, in order that trustees might be able to obtain a better yield for their beneficiaries, many of whom are widows and others dependent upon income from this source. I have not yet heard any good reason why this action should not be taken by the Legislature by including among the investments legal for savings banks and consequently for trustees (with, of course, proper safeguards) public utility and telephone bonds and railroad equipment obligations, and I should also feel that bonds collaterally secured by bonds which are legal, with a proper margin of course, should likewise qualify."

Relative to the effect of the present money market upon the situation, another speaker pointed out that the present is a time of falling interest rates, likely to continue for some time. "Before 1923, during that period of falling interest rates, funds could not find investment in good mortgages, for there was a literal 'mortgage panic,' and savings banks were forced to buy bonds at a premium. It was shown that at present the mortgage market is quite flat and savings banks of New York State will presently have to re-

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Dec. 6	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	140¼	83	143
Ala. Pwr., $7 cum. pf.—no par	113	107	112½
Allis-Chalmers Mfg., 6% com.	115	88	118⅜
Aluminum Co. of Amer., com.	133	67½	145½
Aluminum Co. of Amer., 6% pf.	104½	101½	104½
Amer. & Foreign Pwr., 7% pf.—no par	105½	86½	108
Amer. & Foreign Pwr., com.—no par	28	18¾	30⅜
Amer. Bosch Magneto, com.—no par	23	13	26⅜
Amer. Brown Boveri Elec†	14⅜	5½	39⅜
Amer. Brown Boveri Elec., pf. $7	59½	40	98
Amer. Gas & Elec., 6% pf.—no par	105½	95½	105
Amer. Gas & Elec., com.†—no par	113	68⅜	125
Amer. Lt. & Trac., 6% pf.	112	112	120
Amer. Lt. & Trac., new com.	175	164½	186
Amer. Pwr. & Lt., 6% pf.	106	97½	105
Amer. Pwr. & Lt., com.†—no par	63½	54	73⅜
Amer. Pub. Serv., 7% pf.	a 99½	94	104
Amer. Pub. Serv., com.†	70	65	75
Amer. Pub. Utilities, 7% pfd. pf.	a 89	73	90
Amer. Pub. Utilities, 7% pr. pf.	a 95½	92	96½
Amer. Pub. Utilities, com.	k 57	65	70
Amer. States Sec., A	4¼	2½	4½
Amer. States Sec., B	4¼	2½	4½
Amer. Superpwr., 6% pfd. pf.—25	k 29	26¼	29½
Amer. Superpwr., 6% 1st pf.	l100	....	....
Amer. Superpwr., Class A†—no par	41	27½	41½
Amer. Superpwr., Class B†—no par	41	28½	43
Amer. Wtr. Wks. & Elec., 6% pf.	103½	99½	103½
Amer. W. W. & E., com. new—no par	60	46	72½
Anaconda Copper cap. $3	53	41½	53½
Appalachian Electric Pwr., 7% pf.	107	100	105
Arkansas Pwr. & Lt. 7% pf.	106½	101	107
Assoc. Gas & Elec., $3.50—50	54	....	....
Assoc. Gas & Elec., pf.—$6—no par	95	85	96
Assoc. G. & E., Class A, 10—no par	49½	35	50½
BABCOCK & WILCOX, 7% com.	126	113	132
Binghamton L., H. & P., $6 pf.	101	93	102
Birmingham Elec., pf.—$7—no par	110	105	110
Blackstone Valley G. & E., 6% pf.	107	103	105
Blackstone Valley Gas & Elec., 10% com.—50	132½	98	154½
Blaw-Knox, com.†	d105	70	111½
Brazilian Trac., Lt. & pwr., com.†	f223½	....	....
Broad River Pwr., 7% pf.	103	97	104½
Brooklyn Edison, 8% com.	192	148½	203½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	l 26⅜	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	l 30½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	99	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	l109½	107	109½
Central & S.W. Util., $7 pf.—no par	a 98½	92½	99
Central & S.W. Util., pr.ln.$7 pf.—no par	a103½	98½	104½
Central Ark. Ry. & Lt., 7% pf.	106	100	104
Central Ill. Pub. Serv., $6 pf.	a95	88½	96
Central Ind. Pwr., 7% pf.	a 94	85½	95½
Central Maine Power, 6% pf.	95	....	....
Central Maine Power, 7%	106	102	106
Central Pwr. & Lt., 7% pf.	103½	100½	103
Central States Elec., 7% pf.	99	93	97
Central States Elec., com.†	m 29½	17½	30½
Century Elec., 6% com.	m136½	114	162
Chicago Fuse Mfg., com.—$2.50 no par	a 31	30	35½
Cincinnati Gas & Elec., 5% com.	a101½	96½	101½
Cities Service, $6 pf—no par	l 95½	87	94½
Cities Service, pf. B—no par	l 8½	8	8½
Cities Service, pf. BB—no par	l 88	80½	86
Cities Service, com.—20	l 52½	40	58½
Cities Service, Bks. Shrs.—10	l 25½	22½	27
Cities Service Pwr. & Lt., 7% pf.	105½	100½	106½
Cities Service Pwr. & Lt., 6% pf.	k 94½	90	95½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	112	108	112
Cleveland Elec. Illg., 10% com.	330	285	340
Columbia Gas & Elec., 6% pf.	108½	99½	108½
Columbia G. & E. com. $5—no par	91½	82½	98½
Columbus Elec. & Pwr., $2 com.—no par	67	....	....
Columbus Elec. & Pwr., 7% pf.	108	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	k105½	98½	106
Columbus Ry., Pwr. & Lt., 6½% pf. B	103	96	104
Columbus Ry., P. & L., com.—no par	100	75	105
Commonwealth Edison, 8% com.	a169	138	173
Commonwealth Pwr., 6% pf.	103½	91½	103½
Commonw'th Pwr., $2, com.—no par	65	48½	78½
Conn. Lt. & Pwr., 8% pf.	118	119	123
Conn. Lt. & Pwr., 7% pf.	112	112	118
Cons. Gas of N. Y., pf.	101½	93	101½
Cons. Gas of N. Y., com $5—no par	118½	94	121½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	a111½	111	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	a114	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	a115½	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	a129½	127	130½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	a 68½	51	71
Consolidated Pwr. & Lt., 7% pf.	105	100	106
Consumers Pwr., 6% pf.	104½	100	102
Consumers Pwr., 6.6% pf.	106½	103	105½
Continental Gas & Elec., 8% pfc. pf.	108½	103	106½
Continental Gas & Elec., 7% pr. pf.	105½	100	103½
Conti. G. & E. com. $4.40—no par	k230	210	225
Crocker Wheeler, com.†	23	23	35
Crocker Wheeler, 7% pf.	80	78	88
DALLAS PWR. & LT., 7% pf.	110	107	110½
Dayton Pwr. & Lt., 6% pf.	108	101	109
Detroit Edison, 8% com.	167½	133½	168
Dubilier Condenser, com.—no par	k 2½	2	5½
Duke Pwr., cap.	125	115	130
Duquesne Lt., 7% pf.	116	114½	117½
EASTERN NEW YORK UTIL., $7 pf.	110	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	12½	9	14
Eastern States Pwr., pf.	97½	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	d254	217	267
El Paso Elec., 7% pf.	108	105	107½
Elec. Bond & Share, 6% pf.	l1C9½	105½	110½
Elec. Bd. & Sh. Sec., com. $1—no par	l 74½	67½	80⅜
Electric Household Util.†	a 13	11	15⅜
Elec. Investors, 6% pf.—no par	98½	92	97
Elec. Investors, com.†—no par	42⅜	32½	44½
Elec. Pwr. & Lt., ctfs. pf.	108½	96	109
Elec. Pwr. & Lt., ctfs., 40% pd.	k 120½	103½	120
Elec. Pwr. & Lt., ctfs., com.—no par	27	16½	29½
Elec. Refrig. cap.†	8½	5½	37½
Elec. Ry. Securities, com.—no par	6½	....	....
Elec. St. Battery com. $5.25—no par	74½	65½	81
Elmira Wtr., Lt. & R.R., 7% pf.	104½	99	101½
Empire Pwr., pfc.†	34⅜	26	39
Engr. Pub. Serv., $7 pf.—no par	107	93½	108½
Engr. Pub. Serv., com.—no par	34⅜	21½	39½
Eureka Vacuum Cleaner, com. $4—no par	78½	60	77½
FAIRBANKS MORSE, 7% pf.	d107	107½	113
F.-M., com.—$3—no par	35½	30½	43⅜
Federal Lt. & Trac., com. $1.40	k 39	37½	47
Federal Lt. & Trac., $6 pf.—no par	98	91½	100
Florida Pwr. & Lt., 7% pf.	106½	102½	107
Ft. Worth Pwr. & Lt., 7% pf.	l112	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	70	68	72
Galveston-Houston Elec., com.	33	26	32
Gen. Elec., $3 com.—no par	131½	81	146⅜
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A $1.50—no par	k 36½	34	47½
Gen. G. & E. (Del.) pf. A $3—no par.	k122	113½	123½
Gen. G. & E. (Del.) pf. A $7—no par	k108	100	110½
Gen G. & E. (Del.) pf. B $7	k103½	96	105
Gen. Pub. Serv., $7 cum. pf., no par.	k113½	105½	113½
Gen. Pub. Serv., com., no par	15½	11½	18
Ga. Ry. & Pwr., 5% pf.	k125	119	125
Ga. Ry. & Pwr., 7% pf.	k113½	106	110
Gt. Western Pwr., 7% pf.	k104	..	..
IDAHO PWR., 7% pf.	108	103	109
Ill. No. Utilities, 6% pf.	a 98½	92	98½
Ill. Pwr. & Lt., 7% pf.	104	99	101½
Ingersoll Rand 6% pf.	k 88	87½	96½
Int. Combus. Engr., com. $2—no par	54½	40½	64
Int. Combustion Engr., 7% pf.	102½	101	103½
Int. Util., Class A—$3.50—no par	50½	28	53
Int. Utilities, Class B—no par	11½	3	11½
Interstate Pwr., pf.—$7—no par	97½	93	98
Interstate Pub. Serv., 7% pf.	101½	98	99½
Iowa Ry. & Lt., 7% pf.	98½	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	107	97½	105
Johns-Manville, com.†—no par	122	55½	126½

Stock Exchange: aChicago; kSt. Louis; ePhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Dec. 3. lBid price Wednesday, Dec. 7. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Dec. 6	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k116	112	116
Kansas Gas & Elec., 7% pf.	i108½	103	108
Kentucky Hydro-Elec., 7% pf.	a103	94½	104
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	115	110	115
Kentucky Utilities, 6% pf.	100	95	101
LACLEDE GAS LT., 12% com.	219	173½	267½
Lehigh Pwr. Sec., com.—no par.	20½	15	22
Long Island Ltg., 7% pf.	111	107	112
Long Island Ltg., com.†—no par.	166	139	180
Los Angeles Gas & Elec., 6% pf.	102½	98	104½
Louisville Gas & Elec., cl. A. $1.75	26½	23½	27½
MAN. ELEC. SUPPLY, cap. $5—no par	56½	43	132
Manila Elec., com.†—no par.	k 52	f 40	60
Maytag Mfg., com. .50—no par.	32	23½	34½
Memphis P. & L., pf.—$7—no par	109½	107	109
Metropolitan Ed., pf.—$6—no par.	k105	93	100
Metropolitan Ed., pf.—$7—no par.	109	104	108
Metropolitan Ed., com. $5—no par.	75	60	72
Middle West Utilities, 7% pf.	a118½	110½	118½
Middle West Util., 8% pr. lien	a125½	117½	127
Middle West Util., com. $6—no par	a124	108	124
Midland Utilities, pr. ln. 6% pf.	a105	91½	96
Midland Utilities, 7% pf. A	a100½	96½	103½
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 99	98	101½
Minn. Pwr. & Lt., 7% pf.	i108½	104	108
Miss. River Pwr., 6% pf.	106	94	104½
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	109½	101½	112
Mohawk Hudson Pwr., 2d pf.—$7—no par.	114	98	112
Mohawk Hudson Pwr., com.—no par	28½	20½	32½
Montana Pwr., 5% com.	k 102½	81½	109½
Montreal Pwr., 7½% com.	f 93½	....	....
Mountain States Pwr., 7% pf.	102	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	109	98	110
National Carbon, 8% pf.	m137	130½	139½
National Elec. Pwr., A†	a 26½	22	28½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	k 70	....	....
National Pwr. & Lt., pf.—$7—no par	109	101	110
National Pwr. & Lt., com.†—no par.	22	19½	26½
National Pub. Serv., 7% pf.	100½	93	100
National Pub. Serv., 7% pfc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par.	22½	18½	24
National Pub. Serv., B com.—no par	27½	14	28½
Nebraska Pwr., 7% pf.	i109½	106	109½
Nevada-Calif. Elec., com.	35	24½	36½
New Brunswick Pwr., 4% pf.	60	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	101	98½	102
New Eng. Pub. Serv., pf. $7.	98	95	99
New Orleans Pub. Serv.—7% pf.	108	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	95	91	97
N. Y. Central Elec., 7% pf.	102½	101	104
New York Power & Light, 6% pf.	101	....	....
New York Power & Light, 7% pf.	114	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	k 28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	116	112½	116
No. Amer., 6% pf.—50.	54	50	55
No. Amer., com.—10	59½	45½	64½
No. Amer. Edison, $6 pf.—no par.	k103½	96½	105
No. Caro. Pub. Serv., pf.—$7—no par	102	93	103½
Northeastern Pwr., com.	20½	14½	25
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par.	17	9½	18½
No. Ont. Lt. & Pwr., 6% pf.	k 94	84	95
No. Ont. Lt. & Pwr., 4% com.	72	73	78
No. States Pwr., (Del.) 7% pf.	109½	100½	110
No. States Pwr., (Del.) 8% com.	131½	109½	133
No. Texas Elec., 6% pf.	k 45	65	70
No. Texas Elec., com.	33	27	36
OHIO BRASS, com. B $4—no par.	96	74	110
Ohio Brass, 6% pf.	98	100	107
Ohio Pwr., 6% pf.	103½	96	103
Ohio Pub. Serv., $6 pf.	101	95	96½
Ohio Pub. Serv., 7% pf.	110	103	109
Ohio River Edison, 7% pf.	108½	103	109½
Oklahoma Gas & Elec., 7% pf.	107	...	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	45½	21	46½
Pacific Pwr. & Lt., 7% pf.	i106½	102	106
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 79	75½	80
Penn-Ohio Edison, 6% pf. no par.	94	80½	94
Penn-Ohio Edison, 7% pf.	108	97½	110½
Penn-Ohio Elec., 7% pf.	m102	99	103
Penn-Ohio Pwr. & Lt., 7% pf.	108	99	110
Penn Pwr. & Lt.—$7—no par.	i110½	107	110
Penn Wtr. & Pwr., 8% com., new.	c 68½	47½	73½
Phila Co., 5% pf.—50.	k 46½	40	47
Phila. Co., 6% pf.—50.	52½	50	53½
Phila. Co., com.—50.	140	85½	140
Phila. Elec., 8% com.—25.	c 54½	46½	58½
Portland Elec. Pwr., 7% pf.	102	97½	103
Portland Elec. Pwr., 6% pf.	84½	78	84
Portland Elec. Pwr., 6% 2d pf.	72	55	70
Portland Elec. Pwr., com.	33	22	30
Potomac Elec. Power, pf.	i111½	....	....
Pwr. Sec., pf.—no par.	k 50	40	56
Pwr. Sec., com.—no par.	k 12	5	15
Public Serv. of Colorado, 7% pf.	i104	99	103
Pub. Serv. of N. J., 6% pf.	103½	98½	105
Pub. Serv. of N. J., 8% pf.	k134	125	135½
P. S. of N. J., $2 com.—no par.	42½	32	46½
Pub. Serv. of No. Ill., 6% pf.	a111½	101½	111½
Pub. Serv. of No. Ill., 7% pf.	a120½	112½	119½
P. S. of No. Ill., com. $8—no par.	a160	140½	161½
Pub. Serv. of No. Ill., $8 com.	a159	132	161½
Pub. Serv. of Okla., 7% pr. ln.	104	90	103
Pub. Serv. Elec. & Gas, 6% pf.	k100	102	110½
Puget Sound Pwr. & Lt., 7% pr. pf.	113	103½	113
Puget Sound Pwr. & Lt., $6 pf.—no par.	85	...	...
Puget Sound Pwr. & Lt., com.	k 36½	29½	38
RADIO CORP. OF AMER., $3.50 pf.—50	55½	49	57
Radio Corp. of Amer., com.—no par.	96	41½	101
Rochester Gas & Elec. 6% pf. D.	105	101	103½
Rochester Gas & Elec., 7% pf. B.	105½	105	107
Rochester Gas & Elec., 6% pf. C.	104½	101½	103½
SAFETY CABLE, com. $4.	m 58	52½	74½
San Joaquin Lt. & Pwr., 7% pr. pf.	111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	75	70	75
Servel Corp.	31cts	10cts	10½
Sierra Pacific Elec., 2% com.	k 28	24½	31½
Sioux City Gas & Elec., 7% pf.	106½	99	105½
Southeastern Pwr. & Lt., pf.—$7 no par	i110½	....	....
Southeastern Pwr. & Lt., pfc. pf.	i 86	....	....
Southeastern Pwr. & Lt., com.—no par	43	29½	46
So. Calif. Edison, 8% pf.	40	36½	43
So. Calif. Edison, 7% pf.	28½	27½	29½
So. Calif. Edison, 6% pf.	25½	24½	26½
So. Calif. Edison, 8% com.	41½	31½	42
Southern Cities Utilities, 7% pf.	k 75	67	90½
Southern Cities Utilities, com. $4.	32½	31	42½
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	89	83	91½
Southwestern Pwr. & Lt., 7% pf.	k112	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf.	103	95	105
Standard Gas & Elec., 8% pf.	64½	57½	66½
Standard Gas & Elec., 7% pr. pf.	110	103	112
Standard G. & E., com. $3.50—rts.	60½	54	65½
Standard Power & Light, com.	28½	22	32
Standard Pwr. & Lt., 7% pf.	103	98	102½
Staten Island Edison, pf.—$6—no par.	100	99	103½
Superheater, $6 com.—no par.	171	170	185
Syracuse Lighting, 7% pf.	110	103	111
Syracuse Lighting, 8% pf.	117½	....	
TAMPA ELEC., com. $3.	63	....	....
Tenn. Elec. Pwr., 6% pf.	101½	92	102
Tenn. Elec. Pwr., 7% pf.	108½	103	109
Terre Haute, Ind. & East. Trac., 5% pf.	26	20	30
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	i113	104	112
Tide Water Pwr., 8% pf.	109½	105	111
Timken Roller Bear., com.—$4 no par.	130½	78	142½
Toledo Edison, 7% pf.	i109	102	107
Toledo Edison, 6% pf.	k100	95	97
Toledo Edison, 6% com.	100½	93	103
Tri-City Ry. & Lt., 6% pf.	96½	96	99
UNITED GAS & ELEC., 6% pf.	102	98	103
United Gas & Elec. (N. J.) 5% pf.	74	70	75
United Gas Impr., 8% com.—50.	c 110½	89½	118½
United Lt. & Pwr., pf.—$4—no par.	54	50½	57
United Lt. & Pwr., pf.—$6.50—no par.	95	87	97½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	m 19	15	24
Utah Pwr. & Lt., 7% pf.	i109	104	108½
Utica Gas & Elec., 7% pf.	106	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	97½	93	100
Utilities Pwr. & Lt., com. A $2.	30	27	34
Utilities Pwr. & Lt., com. B $1—no par.	21½	13½	23½
VERMONT HYDRO-ELEC., 7% pf.	96	95	100
Virginia Elec. & Pwr., 7% pf.	109	105	110
Virginian Pwr., 7% pf.	m108	....	....
Virginian Pwr., com.	75	....	....
WAGNER ELEC., 7% pf.	b 90	68	90
Wagner Elec., com.—no par.	b 31½	18½	39½
Washington Ry. & Elec., 5% com., ex. div.	j460	...	....
Washington Ry. & Elec., 5% pf., ex. div.	j100½	...	...
Washington Wtr. Pwr., 8% com.	167	136	182
West Penn Elec., 7% pf.	112	102	112½
West Penn Elec., Cl. A $7.	k108½	97½	111
West Penn Pwr., 7% pf.	116½	111	118
West Penn Pwr., 6% pf.	108½	100½	109
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	k102	98	101½
Western States Gas & Elec., 7% pf.	105	96	105
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	93½	67½	94½
Weston Elec. Instrument, Cl. A $2—no par.	k 31½	30	34½
Weston Elec. Instrument, com.—no par.	14	11	18½
Wheeling Elec., 6% pf.	103	95	104
Worthington Pump, 7% pf. A.	k 43½	46	61½
Worthington Pump, 6% B.	k 40	37	54½
Worthington Pump, com.	30	20½	46
YALE & TOWNE com. $5—25.	75	70½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Dec. 3. *l*Bid price Wednesday, Dec. 7. *m*Latest quotations available. †Dividend rate variable.

invest a half billion dollars now invested in maturing government bonds. In the face of this, money is bound to flow into the savings banks during a time of falling interest rates, and these enlarged funds will have to be invested."

Speaking on behalf of trustee interests, one of their representatives stated that it is increasingly difficult for trustees to get proper investments, that investors not bound by legal restrictions are large investors in utilities, and that in security as well as in every other capacity they compare very favorably with legal securities. Electric light and power are more and more a matter of common necessity, this speaker asserted. In the last ten years legal railroad bonds have increased approximately $90,000,000, less than 3 per cent, while savings bank deposits have increased $2,000,000,000, or more than 100 per cent.

International Utilities Corporation's Rapid Expansion

The International Utilities Corporation is unique in that it comprises a group of properties through various sections of both the United States and Canada. The properties have been chosen for the most part in areas of rapidly increasing population and industrial expansion.

Although the company has not been established long enough to show a proved earnings record of a period of years, the operating subsidiaries have shown marked improvement in earnings during the past three or four years. One feature of the company's recent report is the substantial depreciation reserve which is being built up. In the corporation's balance sheet as of Dec. 31 last depreciation account amounts to approximately 9 per cent of total fixed capital account, and the earnings statement for the year ended May 31 last shows depreciation, depletion and retirement reserve set aside amounting to more than 20 per cent of net earnings.

International Utilities shows attractive earnings record during the past two years. For the twelve months ending July 31 last net earnings amount to $1,961,937, which is an increase of 33 per cent over the previous year. Material progress was made in all branches of the business with one exception, that of ice, which is an extremely minor part of the company's operations.

The capitalization of the company as of July 31 comprises funded debt of $16,775,465, 29,728 shares of seven-dollar preferred stock and two classes of common stock, of which there were 131,248 shares of class A and 463,598 of B stock outstanding.

Business News and Market Conditions

Grounding Policy Will Benefit Electrical Industry

D. Hayes Murphy Believes It Will Support the Promotion of the Better and Cheaper Wiring Campaign Sponsored by the Industry

ADOPTION of a grounding policy by the National Electrical Manufacturers' Association early in November clarified a perplexing problem and gave support to the promotion of the "better and cheaper" wiring campaign sponsored by the electrical industry, in the belief of D. Hayes Murphy, vice-president of the N. E. M. A. in charge of the Supply Division. "These recommendations are directed toward producing the safest, most efficient and cheapest service in wiring and to protect against only those hazards which are actually present," said Mr. Murphy. "Our minds must be freed of narrow restrictions imposed by narrow commercial interests and released for constructive action toward the wise revision of the 1928 National Electrical Code. Is there any engineer or commercial or financial man afraid to take his chances with any rules or any codes which are openly arrived at with all interests represented?" asked Mr. Murphy.

The N. E. M. A. grounding policy, was indorsed by the committee on grounding and approved by the casualty and fire prevention committee of the association; R. W. E. Moore is chairman of both committees. The approved policy, which is virtually the same as that recommended and published on page 1069 of the Nov. 19, 1927, issue of the ELECTRICAL WORLD, is as follows.

1. That secondary circuits of systems should be grounded as per the National Electrical Code.

2. That non-current-carrying exposed metal parts of fixed non-movable equipment in industrial and domestic locations should be grounded, with exceptions to be specified, such as the use of knob-and-tube wiring under certain conditions.

3a. That in industrial plants, other than office, the exposed non-current-carrying parts of all portable equipment (except fan motors) designed to be moved should be grounded.

b. That portables in the offices of industrial plants, residences and all other locations operating at below 150 volts (to ground) need not be grounded.

c. In all locations the exposed metal non-current-carrying parts of portable equipment operating at 150 volts and above (to ground) should be grounded.

4. That the use of any circuit conductor for the grounding of portable or fixed equipment or devices is undesirable and under certain conditions unsafe.

5. That a third wire, or approved conduit, or approved armor of armored cable, or approved metal raceways, may be used for the grounding of portable and fixed equipment, and devices.

"The whole movement for better wiring, which is attracting so much attention at the present time, is centered around the question of grounding," said Alfred E. Waller, managing director of the N.E.M.A. "Unless the whole subject of grounding is intelligently handled, there is likely to be some rule or regulation passed which would in large measure retard the development of the more economical but safe wiring that we are trying to obtain."

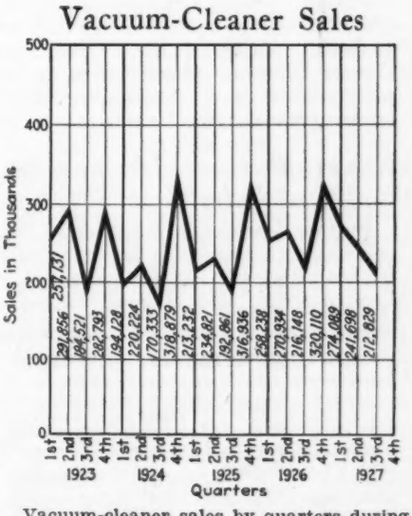
Electrical Heat Treatment Discussed

Manufacturers Are Told that Change-Over Should Be Based on Proper Research and Consideration of All Problems.

ELECTRICAL heat in the heat treatment of metals, as compared with other methods, was the principal theme of the conference on industrial electrical heat treatment held jointly by the Manufacturers' Association of Connecticut and the electrical engineering department of Yale University at New Haven, on Nov. 30. More than 200 attended the conference, and papers were presented by experts from a number of industrial plants as well as by members of the staff of Yale University. At the dinner, E. Kent Hubbard, president of the manufacturers' association, told of the objects of the joint research committee which the association maintains together with Yale University. He cautioned manufacturers against hasty changing over of their plants to electrical heat treatment without due research and consideration of their particular problems, as in many cases their position or other factors might make the continuance of other forms of heat advisable.

In the opening paper of the conference, prof. Charles F. Scott summarized the situation in regard to electrical heat treatment. Among the advantages cited by him were more convenient and accurate temperature control, uniform liberation of heat to the charge, uniform distribution of heat to avoid hot spots, constancy of radiation that is impossible to obtain in fuel furnaces where the path of the gases is affected by the disposition of the material being treated, lower labor costs and decreased maintenance.

Several other papers were presented at the morning and afternoon sessions. At the evening session. A. H. D'Arcambal, consulting metallurgist, Pratt & Whitney Company, spoke on the hardening of small tools and outlined the advantages in better product, cleaner and healthier working conditions and decreased scrap obtained at the Pratt & Whitney plant by the use of lead baths electrically heated for the heat treatment of small tools.



Vacuum-cleaner sales by quarters during 1923, 1924, 1925, 1926 and the first, second and third quarters of 1927. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

Modern Equipment at Power Exposition

Exhibitors Say That Higher Efficiency and Better Apparatus Are Being Demanded by Industrial Plants

MORE than 500 exhibits completely covered the field of mechanical engineering at the sixth National Exposition of Power and Mechanical Engineering, held at the Grand Central Palace, New York, this week. The scope of the exhibition included not only the field of generation and utilization of heat and power but the allied mechanical fields of heating and ventilation. More than two hundred manufacturers displayed apparatus to meet the modern problems of heating and ventilation. Refrigerating machinery was well represented at the exposition by a group of fifty companies, and a large number of exhibits covered mechanical power transmission and machine-shop equipment. The completeness of the exhibit made it impossible for the visitor who studied the equipment to come away without an excellent knowledge of the developments in the power and mechanical engineering fields. The exhibit of the gas industry showed the extent to which that industry is endeavoring to develop the use of gas as an industrial fuel.

The enormous increase in the pressure at which steam is being generated in central-station plants is reflected in the improvement in boiler construction for high pressures, the use of higher-grade steels and the manufacture of parts from solid forgings. Several companies exhibited valves for 1,350-lb.

pressure arranged for remote control. There were also high-pressure centrifugal pumps and other auxiliary equipment to meet the needs of the new boilers. The effect of the high-pressure trend was seen in virtually every detail of equipment used in a steam-generating station. An automatic nozzle-control steam turbine was exhibited.

Stokers designed to burn all grades of coal from anthracite to lignite were on display. There was an increase in the showing of water-cooled furnace walls, both with metal fins and with refractory back of the tubes. Unit pulverizers are increasing in number. A large number of instrument displays, speed reducers, flexible couplings, refractories, and coal-weighing equipment attested the interest in increased efficiency felt both in the central station and in the industrial plant.

Many of the exhibitors reported a decided increase in business in the power-plant field within the last two weeks, and with inquiries in hand sales at the increased rate were anticipated for the rest of the month. Another trend noted was the increased demand for better equipment for industrial plants and the tendency to buy on quality rather than on price. To this end manufacturers are offering apparatus of higher efficiency and longer life—a factor clearly seen in the exposition.

Jobbers Make Merchandise Recommendations

At the convention of the Electrical Supply Jobbers' Association held at Detroit last month various merchandising recommendations were made by the committees studying particular problems. One of the matters discussed was the sale of household motor-driven devices. Attention was called to the decreasing number of jobbers handling such devices. It was recommended that jobbers become buyers for the dealer and consumer, instead of being sellers for the manufacturer, and that instead of purchasing by brands, they buy according to standards of quality which will meet the requirements of their trade. It also was recommended that investigation be made to determine whether jobbers' stocks and investment in conduit fittings could be reduced and important economies accomplished by the elimination of certain unnecessary intermediate sizes of fittings through the use of face-reducing bushings. Further, it was recommended that universal catalog numbers be assigned to manufacturers of switch boxes now designated by names and types wherever the product of the several manufacturers is comparable in specifications.

Suggestions were made covering the marketing of lighting fixtures and reflectors. The committee renewed the recommendation that the 12-in. nonoscillating fan should be discontinued as unnecessary and once more referred to the desirability of adopting a uniform size for the intermediate fan made between the 6-in. and 12-in. sizes. At the meeting E. Donald Tolles, the association's national representative, also was appointed executive secretary of the association, and he will hereafter perform such duties as have heretofore been executed by the general secretary, Franklin Overbagh.

Market Conditions

BUSINESS continues at a fairly active level that is classed at normal. It is anticipated that the total electrical sales for 1927 will be quite close to those of 1926 and will probably show a decrease of not more than 5 per cent. Inquiries for industrial equipment are active and appliance sales are good. Despite the lessened buying of heavy equipment in New England, manufacturers report active inquiries for special apparatus, particularly from paper mills. There is a strong tendency for industry to use more electrical heating equipment. Electric range sales in that territory are increasing. Improvement in central-station business is noted in the Eastern district, and actual commitments for heavy apparatus are expected within the next 30 to 60 days. The New York, New Haven & Hartford Railroad has appropriated $5,000,000 for its electrical division, and some important sales are anticipated. A utility in the Buffalo district purchased $250,000 worth of substation equipment from the General Electric Company, and paper-mill projects will develop a call for equipment.

An order for $170,000 worth of circuit breakers and another for $90,000 worth of power transformers were placed in the Southeast. The remainder of the business done aggregated a reasonably satisfactory volume. Utility companies are active buyers in the Middle West, with one company buying at the rate of $93,000 per day. Business in that section shows every indication of improvement. On the Pacific Coast orders were light but motor business was active. The Northwestern Portland Cement Company purchased $75,000 worth of equipment for its plant at Grotto, Wash., and the Pacific Coast Cement Company plans beginning the construction of a three-million-dollar cement plant on Jan. 1 next.

Copper Further Advanves in Price—Sales Good

Further advance in the price of copper was accompanied by active business for both domestic and foreign accounts. Lead has also sold in good volume at higher prices. Copper advanced nearly ½ cent per pound, and for the sixth consecutive week domestic sales have been very good. There has been a tendency to meet requirements further ahead than in recent months. Several agencies declined to quote on March metal, whereas others have been willing to take orders spread over the first quarter.

NEW YORK METAL MARKET PRICES

	Nov. 30, 1927 Cents per Pound	Dec. 7, 1927 Cents per Pound
Copper, electrolytic	13⅞	14.125
Lead, Am. S. & R. price	6.425	6½
Antimony	10⅞	11⅛
Nickel, ingot	35	35
Zinc spots	6.20	6.20
Tin, Straits	58⅜	59
Aluminum, 99 per cent.	25	25

Base copper price Dec. 7, 1927, 15¼ cents.

Central-Station Business Improves in Eastern District

An improved tone in central-station demand is noted in the New York district, and current inquiries show marked increase in prospective business as compared with several months past. According to a leading manufacturer, several large orders are in sight for equipment of this character, with actual commitments expected within the next 30 to 60 days. The bookings will include turbo-generators, condensers and auxiliary generating apparatus. Substation requirements are also showing encouraging tendencies, and some sizable orders are looked for after the turn of the year.

Underground conduit demand is looked for at an early date by manufacturers in this line. There is a rather definite movement among the leading utilities throughout the Eastern territory to install a network cable system of underground lines under central regulation in preference to zone substations, and heavy purchases of necessary materials are anticipated, including regulators and accessory equipment.

Electric railway business gives promise of early maturity in the New York territory, and some important sales are expected for such accounts as the New York, New Haven & Hartford Railroad, which has an appropriation of $5,000,000 available for its electrical division; Hudson & Manhattan Railroad, and the municipal subway lines. It is stated that inquiries are being received from these interests for immediate as well as early future requirements, covering line materials, car equipment, motors and other apparatus.

There is an improved situation in the Buffalo district, due largely to the proposed expansion programs of some of the prominent power companies in this territory. One utility has placed an order with the General Electric Company for substation equipment, transformers, switching apparatus, etc., to an amount of $250,000, and is expected to be in the market for transmission-line material, pole hardware and accessories at an early date. The New York Central Railroad has placed a

sizable contract for electrical work and equipment in its new station at Buffalo with a company at New York City. Paper-mill projects at Oswego and vicinity will develop an early call for industrial electrical equipment and will bring about important transmission-line extensions for mill service. A rayon mill development at Utica will be an active factor in the buying of industrial electrical equipment within a few weeks.

Forthcoming construction operations in the Eastern district comprise the following: The Board of Education, Newark, N. J., is asking bids until 8 p. m., Dec. 14, for electrical supplies, electric time clocks and similar equipment. The Oswego Board Corporation, operated by the St. Regis Paper Company, Watertown, N. Y., has plans for a new mill at Oswego, N. Y., to cost upward of $1,500,000. The School District of Allentown, Pa., is asking bids until Dec. 19 for an electric ash hoist. The Counties Gas & Electric Company, Norristown, Pa., will soon begin the erection of a multistory operating and office building at Airy and Barbadoes Streets, reported to cost more than $85,000. The Tacoma Electro-chemical Company, operated by the Pennsylvania Salt Company, Philadelphia, Pa., is arranging plans for a plant at Tacoma, Wash., to cost in excess of $450,000. The City Controller, Pittsburgh, Pa., is asking bids until Dec. 15, for coal-handling equipment for the Ross pumping station.

Breakers and Transformers Purchased in Southeast

The largest order placed in the Southeast was for $170,000 worth of oil circuit breakers for a power company. The only other large order reported was for $90,000 worth of power transformers, also for a central-station company. The remainder of the business done aggregated a reasonably satisfactory volume for this period of the year. One central-station company ordered $4,000 worth of distribution transformers and $3,800 worth of house-type meters. There is a sharp falling off in the orders for line-construction materials.

An ice plant in Florida placed an order for $25,000 worth of synchronous motors, transformers and switchboard equipment. A cotton mill in Georgia ordered transformers and motors totaling $10,000 for an addition to plant, and an order for wiring materials approximating $10,000 is in immediate prospect. A county in Georgia is undertaking the installation of highway lighting equipment on approximately 5 miles of highway, and orders for $10,000 worth of lighting fixtures and wiring materials are in immediate prospect. Other construction projects are as follows: Birmingham, Ala., has contracted with the Birmingham Electric Company for the installation of an ornamental lighting system on Fourth Avenue to cost about $13,000. The Supervising Architect, Treasury Department, Washington, D. C., is asking bids until Dec. 16, for lighting changes in the United States Post Office and Court House at Columbus, Ohio. The Mississippi Power Company, Gulfport, Miss., plans the construction of a transmission line from Gulfport to Bay St. Louis, to operate at 22,000 volts, and the installation of a 600-kw. substation at the latter place.

Special Equipment Sales Heavy in New England

The tendency to postpone buying of heavy equipment in the New England district reported by a number of prominent manufacturers does not point to dull times ahead. The number of inquiries received for power equipment is increasing. Paper mills, in particular, are expanding and are substituting new methods which require electrical equipment. Throughout the metal-working industry there is reported a strong tendency to depend more on electrical heating furnaces. A prominent Rhode Island company recently decided to install 700 kw. of electric furnaces, and a number of orders for units in capacities ranging from 30 kw. to 100 kw. are expected in the near future. A 100-kw. heat-treating furnace for Rhode Island was just sold.

Electric range sales are gaining. A Providence campaign covering two months disposed of 103 ranges. Other appliance business is strong. Contract for the construction of barracks at Camp Devens, costing about $600,000, was awarded. A record high week of contracts awarded, over $17,000,000, presages much business in the district. Other construction projects are as follows: The Whiting Paper Company, Holyoke, Mass., has acquired the local Lyman cotton mills and will expend $1,000,000 in remodeling. The Montpelier & Barre Electric Light & Power Company, Montpelier, Vt., plans rebuilding its hydro-electric power stations at Middlesex and Bolton, Vt.

Sales in St. Louis District at Normal Level

Manufacturers in the St. Louis district report that general business is holding up to a normal level. A contract was signed last week for a turbine unit for the southeastern part of the district at a cost of $60,000. One manufacturer reports that there has lately been an unusual demand for farm-lighting units. The volume of business seems to be holding somewhat above last year, with average individual orders a little smaller, but enough to keep the total up. Jobbers report orders holding up, with inquiries coming in better. Construction projects are as follows: The Benton County Utilities Corporation, operated by the Empire District Electric Company, Joplin, Mo., is negotiating for the purchase of the municipal power plant at Gravette, Ark., and plans extensions. The Texas Power & Light Company, Dallas, Tex., will install an improved street-lighting system in San Marcos, Tex. The United States engineer, Galvestton, Tex., is asking bids until Dec. 23 for one vertical propelling engine of full Diesel type. The Central Power & Light Company, San Antonio, Tex., contemplates construction of a power plant at Fort Davis, Tex. Extensions and improvements will be made in power plant at Del Rio, Tex., including installation of two Diesel engines and other equipment. The Valley Electric & Ice Company, San Antonio, Tex., plans an ice-manufacturing and cold-storage plant at McAllen, Tex., estimated to cost $100,000.

Pacific Coast Orders Light—Motor Sales Active

Specialized orders on the Pacific Coast include a 125-hp. motor for the Boldemann Chocolate Company, an automatic bake oven for San Francisco, to cost $2,300, 200 1/20-hp. motors, valued at $2,500, for calculating machines, and 750 assorted heater switches. The latter business is excellent, showing an early season increase of about 25 per cent over last year's orders. An oil company has bought three oil-well drilling and pumping equipments, valued at $1,500 each. Power-company orders include one carload of Westinghouse ranges, amounting to $20,000, the majority of which are of large size, and one carload of 4-in. fiber conduit. A railroad company bought 2,000 dry and 500 flashlight batteries; 1,000 cross-arms have been exported to the Far East, but the projected pole line in Chile requiring 10,000 poles and 50,000 cross-arms is still in abeyance. Butler Brothers, a mail order house is constructing a San Francisco warehouse requiring 3,800 outlets and two carloads of conduit.

With motor prices close and competition keen, the volume of sales was well sustained. The Northwestern Portland Cement Company purchased for its plant at Grotta near Everett, Wash., two 250-hp. synchronous motors, approximately 2,200 hp. in miscellaneous small motors, one eleven-panel switchboard and 5,000 kva. in transformers. This equipment, costing $75,000, will be delivered by Jan. 1. Other sales covered various motor equipment. The town of Sumner, Wash., is taking bids until Dec. 12 for an ornamental street-lighting system. The Pacific Coast Cement Company, a subsidiary of the Pacific Coast Company, has secured a 19-acre site in Seattle and will start construction the first of the year on a three-million-dollar cement plant.

Construction projects in the territory are as follows: Tucson, Ariz., has authorized the installation of an ornamental lighting system on North Main Street. Calexico, Cal., plans an ornamental lighting system in the business section, to cost about $75,000. Los Angeles, Cal., will install ornamental lighting systems on portions of Long Beach Avenue and Kings Road. Sacramento, Cal., plans an ornamental lighting system on portions of Alhambra

Boulevard. The Monterey County Ice & Development Company, Salinas, Cal., has approved plans for an ice-manufacturing and cold-storage plant to cost $200,000. The Evergreen Public Service Company, Evergreen, Colo., will make surveys for a transmission line from Evergreen to Brook Forest, about 5 miles. Denver, Colo., will install an ornamental lighting system totaling 110 standards on a number of streets and Roy, N. M., is considering installation of municipal electric power plant, reported to cost about $25,000.

Utility Companies Active Buyers in Middle West

Business in the Middle West is generally good, with every indication of an improvement. Utility companies are busy with an increasing volume of business, daily commitments averaging $93,000 for one large company. Among the interesting items ordered were 150 96-kva. automatic induction voltage regulators, a 5,000-amp. synchronous converter for railway service, nineteen 3,000-amp. 15,000-volt disconnecting switches and a system of piping connections with appurtenances valued at $290,000. Manufacturers of pole-line hardware report good business. One plant in the Chicago district operating 24 hours a day stated that November sales probably would be the largest in its history for any month. Jobbers' sales are increasing in proportion to the general trend of business.

Construction projects reported are as follows: The Signal Corps Procurement District, Chicago, is asking bids until Dec. 20 for eight telephone switchboards and telephone switchboard equipment. The Continental Can Company, New York, plans a four-story plant on West Thirty-fifth Street, Chicago, at a cost in excess of $500,000. The Continental Ice Company, Savanna, Ill., plans an ice-manufacturing plant, estimated to cost in excess of $300,000. The City Council, Fordson, Mich., will take bids early in January for a two-story municipal central station for fire-alarm service, estimated to cost $35,000. The Northern States Power Company plans extensions in transmission lines to Millville, Hammond, Zumbro Falls and vicinity. The Carney Company, Mankato, Minn., will rebuild the portion of its cement mill recently destroyed by fire, at a reported cost of $125,000. The Douglas Street Improvement Association, Omaha, Neb., plans the installation of an ornamental lighting system. The Cincinnati Street Railway Company has filed plans for a one-story power substation on Hopkins Street, estimated to cost about $25,000. The City Council, Toledo, Ohio, has plans maturing for a new central station for municipal police and fire-alarm systems on Erie Street, to cost approximately $300,000. The Wisconsin Power & Light Company is arranging the early construction of a hydro-electric power plant at Beloit, Wis., reported to cost in excess of $400,000, with transmission system.

Okonite Issues Stock and Buys Hazard Wire Division

Two million dollars of fifteen-year 5½ per cent sinking-fund gold debentures and $1,000,000 of 7 per cent cumulative preferred stock were placed on the market this week by the Okonite Company of Passaic, N. J. Proceeds of these issues will be applied toward the acquisition of the plant, assets and business of the insulated wire division of the Hazard Manufacturing Company of Wilkes-Barre, Pa., to the retirement of the entire outstanding issue of the company's 7 per cent 10 year sinking-fund gold debentures constituting its only present debt, to the retirement of the company's entire outstanding issue of 8 per cent cumulative preferred stock and to the retirement of all outstanding notes payable. The financing will further add approximately $590,000 of cash to the working capital.

The Okonite Company, founded in 1878, manufactures insulated electrical wires and cables, including aërial and underground power cables, railway signal wire, etc. Through joint ownership with Callender's Cable & Construction Company, Ltd., of the Okonite-Callender Cable Company, Inc., at Paterson, N. J., the company is also engaged in producing paper-insulated high-tension cable for underground power transmission. The company thus has a direct ownership of two groups of plants and a 50 per cent interest in a third group. Sales in 1926 were $9,372,929. For the four years ended Dec. 31, 1926, the average annual net earnings after depreciation were $568,322.

The Hazard company earlier in the year divided its wire rope and insulated wire business. The Hazard Wire Rope Company was incorporated in Pennsylvania to take over the wire rope division and at the time also purchased the Waterbury Company of New York, including all its wire rope machinery in the factory in Brooklyn, which is being moved to the factory of the Hazard Wire Rope Company in Wilkes-Barre.

Educational Loan Fund Established by Gerard Swope

The establishment of a loan fund of $25,000, the gift of Gerard Swope, president of the General Electric Company, has been announced by President Charles Alexander Richmond of Union College. Under the provisions of the gift, loans are to be awarded to employees or sons of employees of the General Electric Company and International General Electric Company in the United States and to other students of Union of not less than one year residence at the college. The loans, which are to be made from the income of the fund, are to be awarded in the order of preference given above.

Simultaneously with this announcement, President Swope made known that the board of directors of the General Electric Company also has set aside $25,000 to be used as a loan fund for the education of employees or sons of employees of the General Electric Company, but with no restrictions on them as to the college they may wish to attend. Under both funds the recipient is to understand that if in after years he is in a position to do so, he is to repay the amount so loaned to him, with or without interest. Such money as may be repaid will be treated as a revolving fund and will be again loaned under the same provisions.

R. Thomas & Sons Company Elect Directors

At a recent meeting of the stockholders of the R. Thomas & Sons Company, East Liverpool, Ohio, manufacturer of porcelain insulators, the following board of directors was elected for the ensuing year: A. G. Mason, H. R. Holmes, J. E. Way, C. B. Reynolds and P. L. Rigby. The officers of the company are C. R. Thomas, chairman of the board; A. G. Mason, president; H. R. Holmes, vice-president and general manager; J. E. Way, vice-president and sales manager, and H. T. Williams, secretary and treasurer.

Malleable Iron Fittings Acquires Clark-Williams

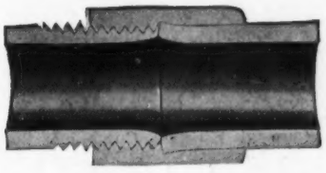
The Malleable Iron Fittings Company of Branford, Conn., has acquired the Clark-Williams Engineering Company of Bridgeport, Conn., manufacturer of pole mounts for application to telegraph, telephone and power transmission lines. The office of the latter company has been moved from Bridgeport to Branford. The Malleable Iron Fittings Company states that it is well equipped to handle the casting, machining and galvanizing work for the pole-mount business and also the pole-line hardware, which will be added to the various equipment formerly sold by the Clark-Williams Engineering Company. Rolland G. Williams has joined the staff of the Malleable company.

THE GILBY WIRE COMPANY, Newark, N. J., manufacturer of resistance wires, expects to move its plant from 123 Jackson Street to Riverside Avenue some time during December. The new plant is located between the Riverside and Woodside stations on the Erie Railroad and consists of three modern factory buildings of brick and steel construction, occupying a plot of ground having an area of more than three acres.

New Equipment Available

Semi-Threadless Coupling

A semi-threadless coupling known as the V. S. electrical fitting has been developed by Charles Hagstedt, 210 East 54th Street, New York, for coupling unthreaded lengths of conduit to a standard threaded length without the necessity of cutting a thread on the cut section of conduit. The coupling is slipped over the unthreaded conduit, and by means of a simple tool the end of the pipe is expanded and at the same time cleaned from interior burrs so as not to require reaming. Screwing up the coupling completes the operation. The coupling fastened in place is shown in the illustration. The device is available in the ½-in. size only, but other



SECTION THROUGH ½-IN. SEMI-THREADLESS COUPLING ATTACHED TO CONDUIT

sizes will be placed on the market at an early date. Mr. Hagstedt states that up to the present time the Underwriters' Laboratories have approved sized up to 1¼ in.

Across-the-Line Type Automatic Starter

An alternating-current across-the-line type automatic starter for use with polyphase and single-phase motors having a maximum rating of 5 hp. at all voltages has been placed on the market by the Industrial Controller Company, Milwaukee. It provides push-button control, low-voltage protection and thermal overload protection. The mechanism is mounted on a panel which fits into a dust-proof cabinet of heavy-gage sheet steel, with door hinged at the side and arranged for a padlock. Terminals are accessible from the front of the cabinet. The I-C time-element, thermal-overload relay is of the melting-alloy type. A hand-reset lever extends through an aperture in the cabinet, permitting the resetting of the starter a few moments after overload occurs by simply pressing the lever without opening the cabinet. The outside dimensions are 7 in. by 8 in. by 4½ in.

HEATING UNITS FOR STEREOTYPE FURNACES.—A line of cast-in, helicoil, sheath-wire, immersion heating units that are applicable to the majority of stereotype metal-melting furnaces now in use by the printing industry has been announced by the General Electric Company. The line includes 5-kw. and 10-kw. units for use on 110-220 and 240-volt circuits. The dimensions of the units are such that they can be applied to standard sizes and forms of stereotype furnaces now being manufactured by several standard firms. Full-automatic control consists of a standard automatic control panel and a Bristol temperature control instrument with a scale from 200 deg. to 1,000 deg. F. and equipped with a special bulb for metal immersion and a temperature-limit fuse.

Network Transformers

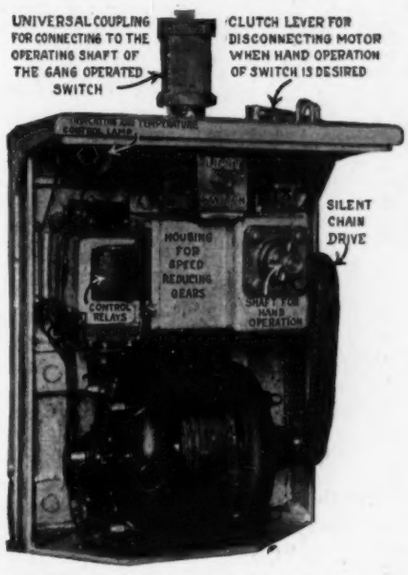
A line of secondary network transformers especially designed to meet the needs of alternating-current network systems as covered by the Westinghouse-Palmer patent has been placed on the market by the Westinghouse Electric & Manufacturing Company. Electrically the transformers are designed to take their proper share of the load, and mechanically, they are designed for installation in a small space. The single-phase transformers of 100 kva. and less will usually pass through a 32-in. manhole, and the 150-kva. size will pass through a 35-in. manhole. These transformers are of the manhole type. On the transformers all bushings and fittings are brought out on one side of the case to facilitate making the connections in the vault. The floor space dimensions have been kept to the minimum and the height to 90 in. or less, so that they can be installed in a manhole with 8 ft. of head room. The grounding switch may be mounted within the transformer tank. A convenient three-phase tap-changer is obtained by mounting the three individual tap-changers on one vertical shaft actuated by a handle either mounted internally above the oil level or externally through the cover.

Edgewise-Wound Resistor

An edgewise-wound resistor, non-breakable and non-corrodible, has been placed on the market by the General Electric Company. This resistor is designed for use on electric cars, electric locomotives and gas-electric buses, and is particularly suitable for application where vibration and exposure to the elements tend to shorten the life of the more fragile cast-grid types of resistors. The new resistor is light in weight. The six-unit type weighs approximately 50 lb. and the four-unit resistor approximately 40 lb.—about half the weight of cast-grid resistors of corresponding capacity. The resistor units are constructed of unbreakable, non-corrodible ribbon rolled from a special alloy. The joints are copper-to-copper and few in number, insuring minimum contact resistance. The ribbon is wound edgewise over heat-resisting and mechanically strong insulation. This insulation is fitted over the edges of reinforced, punched steel bars. The units themselves are supported on steel rods with secondary insulation of mica, and are elliptical in shape.

Motor-Operated Mechanism for Air Circuit Breaker

An air-circuit-breaker motor-operated mechanism designed to complete its operation when started from the control board has been placed on the mar-


UNIVERSAL COUPLING FOR CONNECTING TO THE OPERATING SHAFT OF THE GANG OPERATED SWITCH
CLUTCH LEVER FOR DISCONNECTING MOTOR WHEN HAND OPERATION OF SWITCH IS DESIRED
SILENT CHAIN DRIVE
HOUSING FOR SPEED REDUCING GEARS
CONTROL RELAYS
SHAFT FOR HAND OPERATION

A REVERSIBLE DIRECT-CURRENT MOTOR IS USED ON THIS MECHANISM FOR OPERATING AIR CIRCUIT BREAKERS

ket by the Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago. It may also be started in either direction from a mid-position and will complete its operation and bring the motor to a full stop before it can again be operated from the control board. Two coils serve to close the motor circuits for either direction of operation and to short-circuit the motor armature when the operation is completed. A third coil closes the motor-shunt field during starting and opens it again when the motor has come to a full stop, thus utilizing the field for dynamic braking. The three relays are mounted on a bracket which can be swung to permit of detailed inspection.

A limit switch opens the relay circuits when the operation is completed and rearranges the circuits to be ready for the next operation. Spare contacts for interlocks, etc., are provided to give three circuits closed when the gang-operated switch is open and three closed when the gang-operated switch is closed. The indicating lamp is in series with the motor-shunt field when the field switch is open. This permits a slight flow of current through the circuit at all times and eliminates the danger of moisture due to condensation inside the weather-proof housing.

Electrical Patents

Announced by U. S. Patent Office

1,646,482. ELECTRICAL-FIXTURE-SUPPORTING DEVICE; C. L. Hopkins, River Forest, Ill. App. filed May 20, 1921. Combined electrical and mechanical device. Note: This patent was issued Oct. 25, 1927, but was not previously received from the patent office.

(Issued Nov. 15, 1927)

1,649,180. SURGE RECORDER; J. F. Peters, Pittsburgh, Pa. App. filed Dec. 13, 1923.

1,649,276. ELECTRICAL SWIVEL CONNECTION; A. G. Adam, Sioux City, Iowa. App. filed Dec. 18, 1925.

1,649,280. NEGATIVE ELECTRODE FOR STORAGE BATTERIES; R. C. Benner, Bayside, and L. C. Werking, New York, N. Y. App. filed Sept. 16, 1923.

1,649,305. ELECTRIC CONNECTION DEVICE; P. Hartmann, Brooklyn, N. Y. App. filed Aug. 29, 1921.

1,649,412. SEMI-AUTOMATIC ELECTRIC STOCK HEATER FOR BOLT-HEADING MACHINES; F. R. Long, Berwick, Pa. App. filed Aug. 5, 1921.

1,649,421. ELECTRIC HEATER; J. Schoenfeld, Alameda, Cal. App. filed March 23, 1925. Convection heater.

1,649,422. LIGHTING FIXTURE; R. W. Schweiker, Lansdale Pa. App. filed Aug. 12, 1926.

1,649,475. COMBINED DOOR LATCH AND SWITCH MECHANISM; A. W. Jones, East Orange, N. J. App. filed Dec. 26, 1922.

1,649,484. DOOR LOCK AND ELECTRIC SWITCH; C. Norton, Orange, N. J. App. filed July 15, 1920.

1,649,534. BURGLAR ALARM; J. W. Lawhon, Marysville, Tenn. App. filed Aug. 4, 1924.

1,649,561. FUSE; R. S. Blake, Chicago, Ill. App. filed Aug. 18, 1920. Refillable fuse in which the casing is made up of two tubular sections slidable lengthwise upon one another for the purpose of renewal.

1,649,579. STORAGE-BATTERY ELECTRODE ELEMENT AND PRODUCTION THEREOF; T. A. Edison, West Orange, N. J. App. filed July 24, 1925.

1,649,585. PHASE METER; L. O. Grondahl, Pittsburgh, Pa. App. filed Dec. 8, 1925. For measuring the phase difference of two electromotive forces, two currents, or a voltage and a current.

1,649,590. ELECTRIC SWITCH; F. Henke, Philadelphia, Pa. App. filed Oct. 29, 1926.

1,649,741, 1,649,742, 1,649,743, 1,649,744. ELECTRIC CURRENT RECTIFIER; S. Ruben, New York, N. Y. Apps. filed Sept. 22, and Nov. 18, 1924, and Jan. 2 and March 2, 1925.

1,649,753. METHOD AND MEANS FOR MEASURING ELECTRICAL RESISTANCE; S. Strauss and W. Brandt, Vienna, Austria. App. filed March 24, 1922.

(Issued Nov. 22, 1927)

1,649,851. MEANS FOR MEASURING VOLT-AMPERES; L. A. Paine, Toronto, Ontario, Canada. App. filed Jan. 17, 1923.

1,649,853. SECTIONAL INSULATOR; J. M. Peck, Lima, N. Y. App. filed Jan. 8, 1923.

1,649,885. CONTROL MEANS FOR LIQUID-LEVEL INDICATORS; H. E. Adams and H. L. Decker, Toledo, Ohio. App. filed Aug. 13, 1925.

1,649,893. ELECTRIC SWITCH; C. T. Evans and W. H. Holder, Milwaukee, Wis. App. filed Sept. 27, 1919. Electromagnetically operated switch of large current-carrying capacity.

1,649,923. CONNECTER FOR TRACK CIRCUITS AND TRAIN-CONTROL SYSTEMS; E. K. Post, Collingswood, N. J. App. filed Oct. 23, 1925.

1,649,924. INSULATED ELECTRICAL CONDUCTOR; F. L. Roman, Chicago, and H. T. Winsemius, Congress Park, Ill. App. filed Dec. 12, 1925. With "flame-proof" insulation.

1,649,925. ELECTRIC HEATING DEVICE; A. Ruckstahl, Detroit, Mich. App. filed May 18, 1925. As used in electric furnaces; a means of mounting and carrying the resistance element.

1,649,927. ELECTRIC LAMP SOCKET; E. S. Sanderson, Waterbury, Conn. App. filed Oct. 6, 1926.

1,649,975. MULTIPLE-COLOR ELECTRIC LIGHT BULB; G. M. Parks, Sacramento, Calif. App. filed Nov. 24, 1924.

1,649,986. TEMPORARY STRINGER FOR TELEGRAPH, TELEPHONE AND ELECTRICAL TRANSMISSION LINES; M. K. Sharp, Sharpsburg, Ill. App. filed Jan. 9, 1926.

1,650,014. ELECTRICAL SWIVEL CONNECTER; A. R. Goldrick, Cleveland, Ohio. App. filed Nov. 1, 1920.

1,650,034. INSULATOR; D. H. Osborne, Victor, N. Y. App. filed Feb. 4, 1924. Suspension type; means for connecting in strings.

1,650,064. DEVICE FOR ATTACHING CABLES TO BATTERY TERMINALS; R. L. Dennis, Los Angeles, Calif. App. filed June 16, 1925.

1,650,072. FLAME-ARC FURNACE; J. Jonas and W. Niggelier, Baden, Switzerland. App. filed Nov. 10, 1926.

1,650,142. ACCELERATING ALTERNATING-CURRENT MOTOR; E. L. Martin, Miami, Fla. App. filed April 22, 1924. Self-accelerating motor of the polyphase type.

1,650,143. DEVICE FOR USE IN TRANSMITTING SIGNALS IN CONNECTION WITH FIRE AND BURGLAR ALARM SYSTEMS AND THE LIKE; F. T. Matthews, Brisbane, Australia. App. filed Sept. 7, 1927.

1,650,144. METHOD OF REPAIRING CRACKED OR BROKEN STRUCTURES BY WELDING; R. Mattice, Bethlehem, Pa. App. filed Oct. 28, 1926.

1,650,172. ELECTRICALLY OPERATED SWITCH; C. D. Ainsworth, Wollaston, Mass. App. filed June 28, 1921. Remotely controlled switch adapted to control the starting and running of electric motors.

1,650,176. CENTRIFUGAL FREQUENCY TIME-ELEMENT RELAY; R. V. Appleton, Pittsburgh, Pa. App. filed Oct. 1, 1925.

1,650,190. ELECTRIC SWITCH; S. B. Condit, Brookline, Mass. App. filed July 22, 1922. Disconnecting switch of the air-break type, with means to prevent or retard oxidation of the contact surfaces.

1,650,233, 1,650,234. CONNECTER FOR ELECTRIC CONDUITS; H. E. Plunkett, Hudson, N. H. Apps. filed Jan. 8, 1921, and Jan. 11, 1923. Conduit fitting.

1,650,252. FUSE AND JUNCTION BLOCK; J. A. Wilhelmi, Kankakee, Ill. App. filed July 22, 1921.

1,650,288. PROTECTIVE ALARM SYSTEM; J. D. McDaniel, Vancouver, B. C., Can. App. filed April 10, 1925.

1,650,289. INCANDESCENT ELECTRIC LAMP; J. B. McGinley, Newark, N. J. App. filed Dec. 10, 1926.

1,650,295. ELECTRICAL CONDUCTOR TERMINAL; J. E. Patten, Schenectady, N. Y. App. filed Oct. 26, 1922. For use on stranded insulated conductors.

1,650,319. SEAL FOR GALVANIC CELLS; A. J. Briggs, Syracuse, N. Y. App. filed May 7, 1924.

1,650,320. AUTOMATIC CIRCUIT REGULATOR; P. O. Brown, St. Vincent, Minn. App. filed Nov. 11, 1925. By means of which a circuit is automatically broken and closed within a short period of time by the action of an electromagnet upon an armature operating within the circuit.

1,650,348. ELECTRIC SWITCH OPERATING MEANS; C. E. Hanny, Unionville, Conn. App. filed March 5, 1927. Float switch.

1,650,421. ATTACHMENT PLUG; L. A. Brown, Uniontown, Pa. App. filed March 10, 1926.

1,650,431. ELECTRIC TORCH FOR WELDING, BRAZING AND CUTTING; G. W. Crandall, Plattsmouth, Neb. App. filed March 29, 1926.

1,650,462. FUSE PLUG; N. W. Nutt, Trenton, N. J. App. filed Sept. 17, 1926.

1,650,523. ELECTRICAL APPARATUS; C. F. Kettering and J. C. Federle, Dayton, Ohio. App. filed Sept. 23, 1922. Farm-lighting plant.

1,650,524. ELECTRICAL APPARATUS; C. F. Kettering, Dayton, Ohio. App. filed Sept. 23, 1922. Farm-light system.

1,650,529. CAMPER'S STOVE; L. W. Montgomery, Chicago, Ill. App. filed Dec. 27, 1926.

1,650,530. BATTERY GRID; W. Morrison, Chicago, Ill. App. filed Sept. 10, 1924.

1,650,549. CANOPY FIXTURE; G. B. Thomas, Bridgeport, Conn. App. filed April 13, 1921.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Buenos Aires, Argentina (No. 28,427), for conduit fittings, and another (No. 28,426) for conduit fittings and black friction tape.

An agency is desired in Lisbon, Portugal (No. 28,425), for copper, bare and insulated wire and cable.

E. O. Kutzleb, Nowy, Swiat No. 17, Warsaw, Poland, is desirous of getting in touch with American manufacturers of electric farm-lighting plants with a view to representing such a firm in Poland.

New Trade Literature

UTILITY EQUIPMENT.—The James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, is distributing bulletin No. 300, covering its overhead and underground utility equipment, including new and improved anchors, service connectors, plug cutouts, guy-wire clips, sleeve twisters, deadend eyes, fuse switches, disconnecting switches, choke coils, etc.

GEARS.—Bulletin GEA-853 issued by the General Electric Company, Schenectady, N. Y., argues the merits of solid versus split gears for railway and industrial haulage motors.

ALLOY CAST IRON.—The International Nickel Company, Inc., 67 Wall Street, New York City, is distributing a pamphlet on alloy cast iron to meet high-duty requirements.

SCHOOL LIGHTING.—"The Lighting of Schools.—"AGuide to Good Practice" is the title of booklet No. 344-A issued by the Holophane Company, Inc., 342 Madison Avenue, New York City. The booklet explains school-lighting installations, giving individual treatment to the various departments such as the classroom, the corridor, the gymnasium, etc.

AUTOMATIC SWITCHING EQUIPMENT AND SYNCHRONOUS TIMER.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-573-A, covering its automatic switching equipment for synchronous converters in railway service. It contains an illustration showing the installation of a 2,500-kw. synchronous converter. Bulletin GEA-829 describes its type MF-2 synchronous timer for accurate time indication of the operation of relays and other devices.

AUTOMATIC SWITCHING EQUIPMENT.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing circular 1793, covering its automatic switching equipment for railway service.

ELECTRIC FURNACES AND DISCONNECTING SWITCHES. — The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-37B, in which it describes and illustrates the GE direct-heat electric furnaces, types AD, RRB and RRC. The company is also distributing bulletin GEA-23A, covering its type LG-17B and LG-17C indoor disconnecting switches.

FURNACE WALL BLOCKS.—Bulletin B-34, entitled "Clinker-Proof Long-Life Furnace Walls," issued by the Bernitz Furnace Appliance Company, 80 Federal Street, Boston, describes the Bernitz super blocks of carborundum. Illustrations of typical installations are given and instructions for the installation and care of Bernitz super blocks are included. The company also has issued bulletin B-7, covering the Bernitz carborundum water-wall blocks for water-tube furnace walls.

LABORATORY EQUIPMENT AND PORTABLE INSTRUMENTS.—"Electrical Laboratory Apparatus and Educational Service" is the title of bulletin GEA-450 issued by the General Electric Company, Schenectady, N. Y. The bulletin describes and illustrates alternating-current and direct-current generators and motors, synchronous converters, sine-wave testing sets, magnetic controllers, grids and loading devices, capacitors, circuit breakers, dynamometers, transformers, regulators, arc-welding sets, meters, etc., for laboratory use in technical high schools and vocational schools. Bulletin GEA-158A issued by the company describes its types DP-2 and P-3 portable instruments.

RECORDING INSTRUMENTS.—Bulletin No. 362 issued by the Bristol Company, Waterbury, Conn., describes and illustrates its various types of Bristol recording instruments used in the power plant.

SUPERVISORY EQUIPMENT, RELAY AND CAPACITORS.—Bulletins GEA-574A, GEA-716A and GEA-827 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively the carrier-current selector automatic supervisory equipment, the totalizing relay and capacitors for indoor and outdoor service for power-factor correction.